Consulting Engineer

January
1957

Thoughts from the South

CARY BRECKENRIDGE GAMBLE is a partner in the firm of Cary B. Gamble & Associates, Consulting Engineers, of New Orleans, La. The firm specializes in mechanical and electrical work and is known throughout the nation for design of air conditioning systems. Gamble, engineering head of the firm, is a member of the American Institute of Consulting Engineers. He was one of the organizers of the Gulf Institute of Consulting Engineers, in 1950, a group

—Continued on page 6

Inside Story on POWELL CORROSION RESISTANT VALVES

Corrosion resistant valves may appear to be alike on the outside. But inside -- in trim materials, in design, in manufacture -- there can be a world of difference. And the inside story of Powell Corrosion Resistant Valves is that every valve has PERFORMANCE VERIFIED.

The reason there's a big difference in Powell Corrosion Resistant Valves is quality control. It begins not with manufacture -- but with the very materials which go into Powell Valves. As a final step of Powell's rigidly enforced quality control, every Powell Valve is subjected to an actual line test.

Powell has designed many new types of Corrosion Resistant Valves to meet the needs of the rapidly expanding chemical and process industries. The variety of pure metals and special alloys in which they are available has grown to such an extent that today there is a Powell Corrosion Resistant Valve to control the flow of almost every known corrosive fluid.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our COMPLETE quality line which has PERFORMANCE VERIFIED.

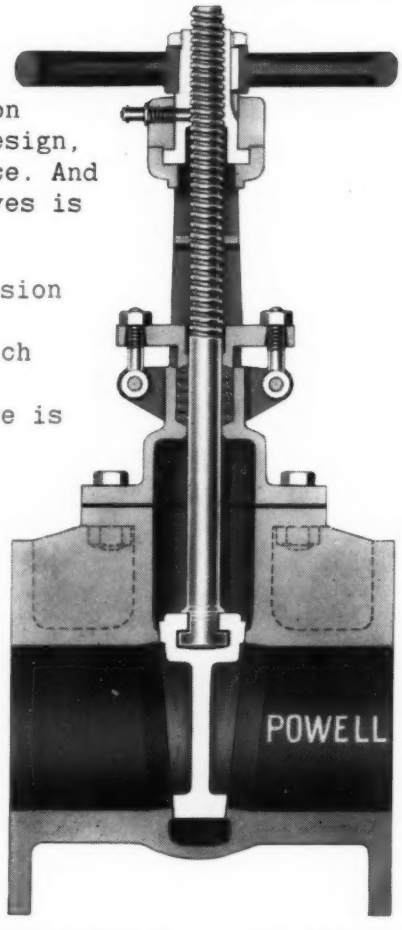

Fig. 2453-SG -- Stainless Steel O. S. & Y. Gate Valve for 150 Pounds W. P.

Fig. 1314-A -- 1500 Pound Integral Bonnet Alloy Steel "Y" Valve.

Fig. 2342 -- Alloy Steel Bolted Cap Swing Check Valve for 150 Pounds W. P.

PERFORMANCE PV VERIFIED

The Wm. Powell Company, Cincinnati 22, Ohio . . . 111th YEAR

POWELL VALVES

BRONZE, IRON, STEEL AND CORROSION RESISTANT VALVES

VOLUME 9 NUMBER 1

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January 1957

FEATURE ARTICLES

DEPARTMENTS

The Engineering Index Service in Public Libraries lists articles from CONSULTING ENGINEER

The Consulting Engineer's Professional Magazine

Cary Breckenridge Gamble

—Starts on front cover

that has since become a Founder Member of the Consulting Engineers Council. He has been active locally and nationally in the American Society of Heating and Air-Conditioning Engineers and the American Society of Refrigerating Engineers, and is a member of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers. Currently he is on the National Council of ASHAE.

A native of the South, Cary Gamble was born in Wilson, North Carolina, and received his B.S. in electrical engineering from Alabama Polytechnic Institute in 1923. After spending a year as a student engineer at General Electric's Schenectady plant, he served as assistant professor of physics at Washington and Lee University. From 1926 to 1936 he worked as an engineer for H. C. Baker Co. and Frigidaire Corp. During 1935 and 1936 he sold, designed, and installed air conditioning equipment for Crawford, Inc.

In 1936, Cary Gamble joined the New Orleans consulting engineering firm of Leo S. Weil and Walter B. Moses as Chief Engineer and Associate. Here he was in charge of such projects as engineering for Stix-Beer-Fuller Department Store, St. Louis, Mo.; Canal Building, New Orleans; and Shell Building, Houston, Texas. In 1941 he became Chief Estimator and in 1942 General Manager for the Associated Mechanical Contractors, of Dallas, Texas, where he was in charge of $1,950,000 in mechanical and electrical contracts at the Blue Bonnet Ordnance Plant, Waco, Teaxs.

In Private Practice

By 1943 he had started his own consulting practice in New Orleans, specializing in marine heating, ventilating, and refrigeration. During this time he served as consultant to B. C. D'Antoni & Associates, Naval Architects, for the heating and ventilating design of the Navy Transport AP 29. Three years later the firm of Cary B. Gamble & Associates, a partnership consisting of Cary B. and Richard W. Gamble, was formed.

Typical Projects

As an example of the scope of the firm's activities, they designed the complete heating, ventilating, air conditioning, plumbing, and electrical systems for the 15-story E. T. Woolfolk State Office Building in Jackson, Miss., including 750 tons of refrigeration and placement of more than 2500 fluorescent lighting fixtures. At the Louisiana State Penitentiary at Angola, all service facilities for the Administration Building were designed by Gamble. Plumbing, heating, and electrical plans are now on the boards for the remainder of the institution. The firm has taken advantage of its own experience to completely redesign the air conditioning and electrical system of its offices—formerly the Petroleum Club quarters in an old building in the center of the New Orleans' business district — to make it one of the most modern engineering offices in the city.

Upgrading the Profession

Cary Gamble is constantly trying to upgrade the consulting engineering profession and believes that joining an organization that is working for the good of the profession accomplishes much more, both for the individual and the profession, than standing on the side lines and waiting for the group to achieve its aims. He expects a great deal of value to come from the Consulting Engineers Council and feels that the more engineers work toward developing CEC, the more good can be expected from it. While not agreeing completely with all the tenets of the Council as presently set down, he believes its overall aims, if realized, will bring consulting engineers more recognition and improved professional business conditions.

Establishing Standards

According to Gamble, "Every state or regional group of consulting engineers should be working independently and through the Council to raise the standards of engineering work done by private consultants and to assure that proper fees are paid for the work accomplished.

"Currently, there is too much shopping around for price by clients. Naturally, these shoppers get what they pay for, poor engineering that can be a hazard to life, health, and property. This is not good, and it can be corrected only by cooperative effort. On a state and regional basis we should set up standards of practice and establish fee schedules. Then, through CEC we can exchange the results of our individual efforts and improve conditions throughout the nation.

Work for Government Agencies

"Several of the state and regional associations are now working out standards applicable to one or more fields of engineering. The Gulf Institute, for example, has a group developing standards and a fee schedule for mechanical and electrical work. At present we have no such standards in Louisiana. This means that there is a wide variation in the quality of work performed and the services rendered the client, with a corresponding variation in fees. This lack of standardization makes it particularly difficult to deal with cities, towns, parishes, and the state. Governmental groups here, as in many parts of the country, are far too conscious of fees and forget to find out exactly what the lower fees represent in the way of engineering services.

GREENLEE BROS. & CO. CUT FUEL COSTS 17%

B&W boilers with Jet Ignition Stokers assure savings despite increased fuel prices

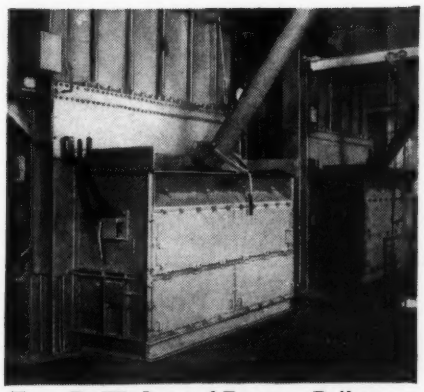
As one of the country's leading machine tool manufacturers, Greenlee Bros. & Co., Rockford, Illinois uses large amounts of steam for all year operation of air compressors and for plant heating. And to maintain profitable overall operation it is important that the steam supply be dependable—and steam generating costs kept to the minimum.

Since the installation of two B&W Integral-Furnace Boilers, Greenlee has enjoyed uninterrupted steam service from a dependable, efficient source. Equipped with modern B&W Jet Ignition Stokers, these units have built a record of operating efficiency while burning a wide variety of Illinois bituminous coal.

At Greenlee, as at other industrial plants using steam, careful consideration of long term costs and proven reliability were important factors in the choice of B&W Integral-Furnace Boiler units.

If your steam production cost is important . . . if you are considering steam plant modernization or expansion for increased dependability and efficiency . . . it will pay you to investigate B&W's more than 90 years of boiler experience. Let us show you what it can do for you.

For further information or assistance write to The Babcock & Wilcox Company, Boiler Division, 161 East 42nd Street, New York 17, N. Y.



Two B&W Integral-Furnace Boilers at Greenlee, equipped with B&W Jet Ignition Stokers, burn a wide variety of Illinois bituminous coal.

HERE'S WHY YOUR STEAM COSTS LESS With B&W Integral-Furnace Units

- Minimum floor space and headroom requirements
- High fuel economy
- Smokeless combustion
- Adaptable to all fuels and firing methods
- Economical fast steaming
- Water-cooled furnace
- Clean, dry steam at all ratings, even with high boiled water concentration
- Quick response to wide and heavy load swing demands
- Easy to inspect and clean
- High availability with least attention

BABCOCK & WILCOX

BOILER DIVISION

G-827-18

"Public and private ownership generally underestimate the tremendous importance of the work that the consulting mechanical and electrical engineers handle in a modern building. There is more and more talk, however, of it being a good building or a bad building in direct proportion to the quality of the engineering work.

Architects' Responsibilities

"Architects, too, are guilty of shopping for price. While this situation is gradually improving, much work needs to be done to convince them that they need the best engineering services rather than the cheapest. When the architect stops to think about it, he will realize that he owes the best in engineering services to his client. The state associations and the Consulting Engineers Council can do much to improve this situation by working with the architectural groups.

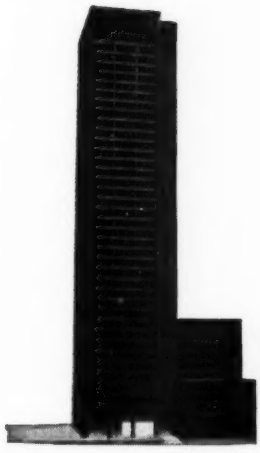
"Another field in which there is much work to be done is licensing. Until about three years ago there was no licensing law in Louisiana for mechanical and electrical engineers, in spite of the fact that this state was one of the first to register civil engineers and architects. The evils in this situation are obvious. State associations, with the assistance of CEC, should try to strengthen registration laws and bring these laws closer together so that an engineer properly licensed to practice in one state could serve clients in other states without too much red tape. Reciprocal registration, retaining the right of any state to reject the unqualified engineer, should be less complicated than it is now.

"Licensing laws in many states are illogical. I know of an instance in which an engineer, fully licensed in several states, applied for a license in another state and was required to take an open book examination based on textbooks used at that state's engineering school. The examination included specialized fields of engineering in which few engineers in private practice have any interest. The scope of the examination too often does not determine the engineer's competence to practice but only proves a specialized academic knowledge.

Looking Ahead

"I believe that engineers in private practice throughout the country can look forward to increased recognition, improved standards, and increased income for professional services through active participation in their local associations and the work of these groups nationally."

world's first bronze building



HOUSE OF SEAGRAM uses largest bronze shapes ever extruded commercially

The architects had a dream: to give New York's Park Avenue the world's first bronze skyscraper. And Chase engineers helped make it real. Constructing the Seagram Building "Curtain Wall" entailed fabrication of straight, true I lengths larger in diameter than ever considered practical. Chase, working with the architects, the General Bronze Corporation and other mills, played an important part in opening new horizons in design.

WHY BRONZE? Mies van der Rohe and Philip Johnson chose bronze for its nobility, beauty of color and structural flexibility. Moreover, the copper alloy called "Architectural Bronze" has mellowing qualities that will give the building a rich brown *patina* as it ages. Practically speaking, bronze requires a bare minimum of maintenance. But first came construction problems.

WHY CHASE? Technical "know-how" plus the most modern facilities eminently qualified Chase for its share of the job. Many of the specially-designed extrusions that make up the bronze facade are historical "firsts." Chase made valuable contributions to the engineering and modification of these shapes—as well as to the production of them. Perhaps you, too, have an architectural dream... *Chase is at your service.*

STRAIGHTENING PROCESS involves drawing shape through a second die.

PAINSTAKING HAND WORK assures that dimensions are micrometer-perfect.

QUALITY CHECK is made at factory of four shapes produced by Chase.

CAREFUL PACKAGING makes sure shapes reach building in flawless condition.

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The Reader's Guide

Survey of the Profession

Every year CONSULTING ENGINEER has made it a practice to publish in the January issue the results of a "Survey of the Profession." Last year the "Survey" dealt with consulting engineer associations. It showed what societies and organizations consulting engineers belonged to, what they got out of them, and what they felt was needed. The compilation of returns proved that consulting engineers belonged to many groups, but it was the general feeling that there was a need for state and national associations representing the particular needs of consulting engineers in private practice. Encouraged by the results of this survey, there have been a number of state associations formed and the Consulting Engineers Council has been established as a national group. This year the "Survey" deals with a different matter. The questionnaires on which it is based asked about age, size, growth, and structure of consulting engineer firms. Prior to this survey very little was known about these matters. The Department of Commerce keeps accurate figures on pottery plants, and citrus fruit canners, but they compile no statistics on consulting engineers. Now, by a study of CONSULTING ENGINEER's "Survey," it is possible for the engineer in private practice to know more about his profession and his position within it.

Precast Concrete

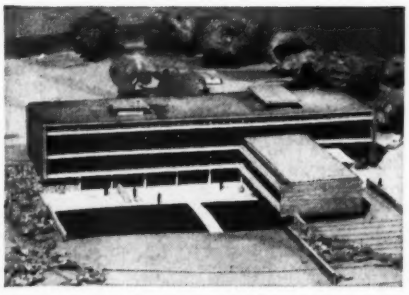
Dr. J. J. Polivka, a consultant in San Francisco, has an article in this issue in which he gives an interesting history of the use of precast concrete in this country. It is surprising to find how much good work was done with precast concrete in the U. S. in the early years of this century. The general thought is that most early precast design was done in Europe, and perhaps it was, but the U. S. was not far behind until the booming steel industry made steel construction so much cheaper than in other parts of the world. Polivka completes his article with a description of some of the more interesting and unusual precast structures of recent years.

Engineer's Building

The series on new buildings designed by consulting engineers for their own occupancy continues in this issue with an article describing Bridgers & Paxton's new quarters in Albuquerque. The building has a solar heating system. They figure that construction costs compare favorably with conventional buildings in the area, and they are collecting operating costs for later publication.

The Best Is Yet To Be

It is also our practice, each January, to call on that excellent industrial economist, E. F. MacDonald (who prepares every month our "Economic News Notes") for an analysis of the coming year as it is likely to affect the financial well being of engineers in private practice. This year things look good. Perhaps they are not quite so bright for the architect who deals primarily in homes and small buildings, but in every category of the economy in which the consulting engineer is involved, the economist looks for continued growth. Industrial Building up 5 percent; Hospitals up 23 percent; Utilities up 13 percent; Sewage Plants up 23 percent. Who could be unhappy about figures like that. No wonder the number of consulting engineer firms has increased about 50 percent in 5 years. There also will be many new firms of engineers in 1957, we are willing to predict, and even more work for established firms.



Wisconsin Farm Bureau Building Cooperative office building, Madison, Wisconsin. John J. Flad & Associates, architects. Berman Electric Company, electrical contractor.

Continental Casualty Building, Toronto. Marani & Morris, architects. H. H. Angus and Associates, mechanical and electrical engineers. Canadian Comstock Co., Ltd., electrical contractor.

National Cash Register Engr. Research Bldg., Dayton. Lorenz & Williams, architects. Schweiger, Heapy & Assoc., consulting mechanical engrs. Wagner-Smith Co., elect. contr.

Erection of Flexicore concrete structural floors is fast on steel frame, above, or on concrete frame or masonry walls.

Smooth, safe work deck is ready for other trades 24 hours after erection of floor. Flexicore clear-spans from girder to girder.

Structural concrete floor requires no extra fireproof ceiling. Columns, girders and beams get usual fireproofing treatment.

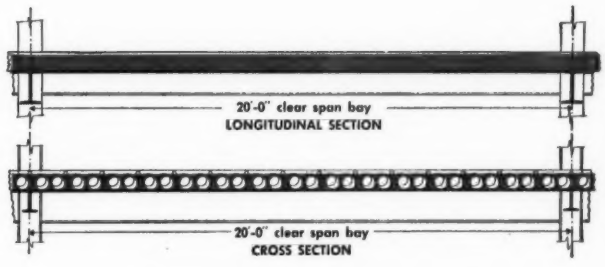
in Flexicore Precast Floors

Needs No Fireproofing

The structural floor of this system is formed of monolithically cast Flexicore concrete units, and requires no fireproofing. Underwriters Laboratories gives a 3-hour fire rating to an 8" Flexicore floor with 1½" concrete topping.

The basic advantages of this system for office building construction include savings in job time and investment. The dry erection of the lightweight units saves construction time. Less structural framing is required because of long, clear spans. Plaster fireproofing on the underside of the floor is eliminated and concrete topping is reduced in thickness to 1½" because of the fire-resistant qualities of the structural floor itself. As a by-product of these savings, overall job time is reduced, providing earlier occupancy.

The Flexicore method is a time-tested system and has been used on over 24,000 buildings in the United States and Canada.



LONG SPANS SIMPLIFY STRUCTURAL DESIGN

The use of Flexicore precast concrete floors in office buildings permits 20' x 20' clear span bays. This means simple framing without intermediate beams, and results in savings in steel and in total weight. The new Flexicore Office Building Manual contains design information, including properties of the Flexicore slab, load curves, special design conditions and design examples.

WRITE OR PHONE YOUR NEAREST FLEXICORE MANUFACTURER

ALABAMA,
Birmingham 1, PO 630
The Alabama Cement Tile Co.

COLORADO, Denver 1, PO 366
Flexicore Company of Colorado

FLORIDA, Tampa, PO 2189
Universal Concrete Pipe Co.

ILLINOIS, Chicago
PO 277, Franklin Park
Mid-West Concrete Pipe Co.

INDIANA, E. Chicago, PO 539
Calumet Flexicore Corporation

MICHIGAN, Livonia, PO 2006
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Molin Concrete Products Co.

MISSOURI, St. Louis Flexicore
PO Box 552, Collinsville, Ill.

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Camden Lime Co.

NEW YORK, Buffalo 6
Anchor Concrete Products, Inc.

NORTH CAROLINA, Lilesville
W. R. Bonsal Company, Inc.

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Lake Erie Flexicore, Inc.
PO 563, Kent, Ohio

OHIO, Columbus 22
Arrowcrete Corporation

OHIO, Dayton 1, PO 825
Price Brothers Company

PENNSYLVANIA, Monongahela
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TEXAS, Houston, 4511 Kyle St.
Flexicore of Texas, Inc.

WEST VIRGINIA, Wheeling
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Schell Industries Ltd.

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Flexicore Co. of Puerto Rico

READERS' COMMENT

[Sic]
Sir:

I do not have to assure you that I read "Consulting Engineer" with interest and maybe, as you will see, too meticulously.

As a handbook editor, consulting editor for Merriam-Webster dictionaries, consulting editor for Electrical World and Commissioner of Planning and Zoning, I am too steeped in "copy" to overlook the kinds of errors your editors make. For example,—

December, page 26. If you dislike spelling "burial" in approved manner why not try "buriol", "bureul", or even a phonetic "berry-all", in stead of "buriel" as you have it twice.

December, page 64. All the journals and associations listed should have initial capitals for all component words except "of", "the", "and", etc. If you dislike capitals so much can we not at least have a Capital A in ("Scientific") "American" and be good citizens?

Such transgressions should not provide the distinction between the "Consulting Engineer" and a mere consulting engineer like the undersigned.

A. E. Knowlton
Editor-in-Chief
Standard Handbook for
Electrical Engineers
Short Beach, Conn.

• "WHAT'S COME TO PERFECTION PERISHES . . . "

Impressed

Sir:

Thank you for the December copy of the CONSULTING ENGINEER which you recently forwarded to me. I enjoyed reading it and would appreciate receiving future copies. I am impressed by the manner in which you present your articles, keeping in mind that an engineer's time is quite limited and that he is only concerned with the meat of what the writer has to say and not the number of pages that he is able to fill.

The article on William W. Moore (cover personality) was very interesting and quite true.

Ambrose R. West
Consulting Engineer
Bethlehem, Pa.

For Engineers . . .

Sir:

We would appreciate a reprint of the article entitled "The Consulting Structural Engineer," by Mr. Ketchum, which was published in the August, 1956, issue.

I would like to take this opportunity to express my appreciation for the many fine articles contained in CONSULTING ENGINEER.

Michael W. Wasell, P. E.
Wasell Engineering Service
Winston-Salem, N. C.

. . . And Architects

Sir:

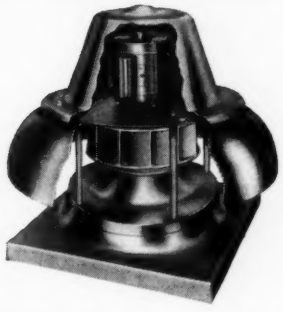
I appreciated very much receiving the reprints that I requested recently, particularly the paper entitled "The Consulting Structural Engineer," by Milo Ketchum (p. 70, Aug. C. E.). In my opinion, I believe that Mr. Ketchum made an excellent and forthright presentation of the structural consultant—

Introducing ...the Roof Ventilator "Twins"

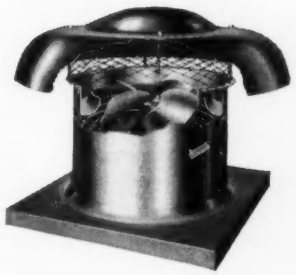
. . . economical space-saving roof units to simplify your ventilating problems . . .

When roof ventilators provide the answer to your ventilating needs, select one of the **nyb** "Twins" for maximum dependability . . . and *economy*, too! The Bell-Ex will exhaust against high resistances effectively from hoods and duct work; the VP-Ex is a sturdy, flexible unit that may be used where resistances do not exceed ¼ inch static pressure. The "Twins" are completely weatherproof and corrosion-resistant, easily accessible for maintenance . . . and of modern design to complement any exterior.

Write today for bulletins 565 and 566 for further details on the Bell-Ex and VP-Ex "Twins"



BELL-EX (B-12) cutaway view showing fan assembly; motor is fully enclosed, continuous duty type, ball bearing.



VP-EX cutaway view showing four-bladed fan, wire fan guard, spun inlet cone and bird screen.

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in particular the subject of the structural engineer's relationship with the architect.

Because a considerable portion of this paper refers to the architectural profession, I suggest that it be published also in an architectural periodical. I feel that many architects would find this paper not only very interesting but also obtain a closer understanding of the structural engineer's problems. I happen to be a member of the N. Y. State Association of Architects who publish a monthly magazine known as "The Empire Architect." If permission may be granted for the publication of Mr. Ketchum's article, I am almost sure that I can prevail upon the editors of "The Empire Architect" to publish the paper . . .

Frank E. Kulas
Consulting Engineer
Rochester, New York

• PERMISSION GRANTED.

For the Highway Commissioner

Sir:

I have read with interest the article in your November, 1956, issue on "Consultants on the Highway Program."

This Society is most interested in changing the policy stated by one of our State Commissioners in this report. I believe the article itself can go a long way toward accomplishing this purpose.

I would appreciate very much your sending me ten copies of this article.

C. V. Maxwell, Jr., Pres.
Mississippi Society of
Professional Engineers
Jackson, Miss.

Service to the Profession

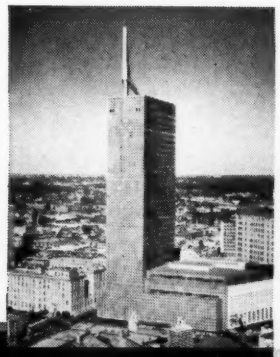
Sir:

I have enjoyed reading CONSULTING ENGINEER and feel that it is offering a needed service to the profession. It certainly provides the consultant with a broad coverage of the functions and personalities of leading engineers in all phases of the profession.

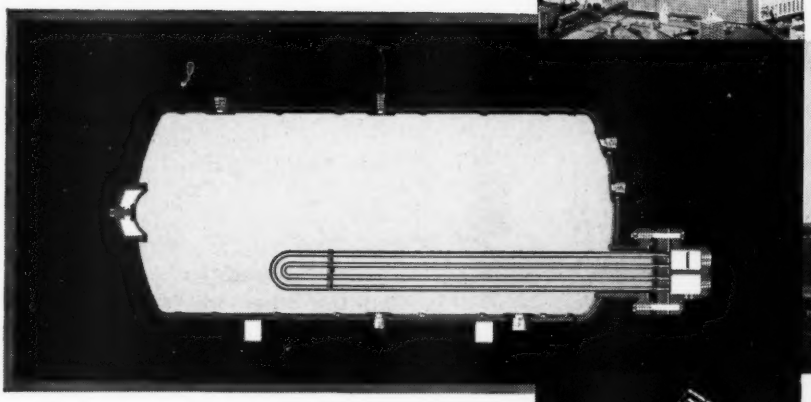
W. R. Kahl
Rummel, Klepper & Kahl
Baltimore, Md.

Sir:

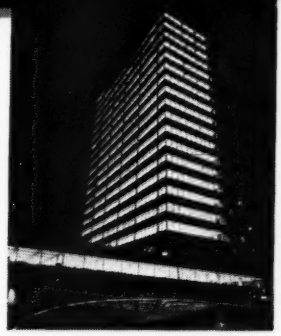
We certainly feel that the magazine, CONSULTING ENGINEER, is doing a terrific job on bringing forth and out into the open all of the ills that beset the consulting engineer. With all of these items being set forth, so



Dallas: Republic National Bank Building. *Architects:* Harrison & Abramovitz; Gill & Harrell. *General Contractor:* J. W. Bateson Company, Inc. *Consulting Engineers:* Jaros, Baum & Bolles. *Mech. Contractor:* Farwell Company, Inc.



Denver: Mile High Center. *Architects:* I. M. Pei and Associates. *Associated Architect:* G. Meredith Musick. *Contractor:* George A. Fuller Company. *Consulting Engineers:* Jaros, Baum & Bolles. *Mechanical Contractor:* Kerby Saunders, Inc.



New York: Lever House. *Architects:* Skidmore, Owings & Merrill. *Contractor:* George A. Fuller Company. *Consulting Engineers:* Jaros, Baum & Bolles. *Mechanical Contractor:* Kerby Saunders, Inc. *Plumbing Contractor:* Gillman-Rous-Pesce Corp.

FOR TROUBLE-FREE, GUARANTEED PERFORMANCE

THEY SPECIFIED P-K *Copper-Lined* HEATERS

These three famous new buildings are at different points of the compass . . . yet they have one thing in common. When it came time to specify storage heaters, they selected P-K. And though they're far separated in miles, these P-K copper-lined heater installations aren't as isolated as they look. A list of famous buildings all over the country using P-K copper-lined heaters is an honor roll of American business.

Why are P-K copper-lined heaters specified for America's finest buildings? For one thing, experienced engineers know the value of having one supplier who carefully makes and assembles (and is responsible for) every component of the heater.

But more important, engineers know that when it comes to vital points of construction, P-K is miles ahead. For example, P-K copper-lined heaters have rolled joints every 12 inches around the full circumference, to allow for longitudinal expansion . . . heavy flanged copper silicon couplings, welded to both the shell and the lining . . . and a special P-K vacuum breaker to protect the lining from sudden pressure fluctuation. Separate hydrostatic and pneumatic tests are made to guarantee leak-proof linings.

There are other points, too, not found in so-called "economy" heaters, that should be specified for any heater you buy. All these critical construction features have been detailed in a fabricating procedure file which we have prepared on copper-lined heaters. We think you will find it helpful. Write today for P-K file 183.

The Patterson-Kelley Company, 1710 Burson Street, East Stroudsburg, Pa. 2577

PATTERSON KELLEY

storage water heaters • instantaneous heaters • converters • fuel oil heaters • freon chillers and condensers

that all affected may scrutinize their problems closely, I feel sure that all consulting engineers are turning toward a brighter future, that is certainly enlightened by your magazine.

Wallace C. Bruch
Nielsen and Bruch
Minneapolis, Minn.

Sir:

I enjoy the magazine thoroughly and think you are doing a great service to the consulting engineers throughout the nation.

John J. Driskell
Consulting Structural Engineer
San Gabriel, Calif.

Sir:

. . . I also wish to compliment you, and the other editors of CONSULTING ENGINEER, for the fine magazine that you are producing. We are very pleased to be on your mailing list.

Russell I. Boyce
Boyce Engineering Associates
Wallingford, Conn.

Sir:

Thank you for sending us a copy of "Open Ceilings Give Better Light at Lower Cost," by R. J. Tuttle. (April C.E., p. 42). We are now working on an open ceiling project and your article has proved of interest. We should like, therefore, if possible six additional copies for distribution to our clients and associate engineers.

W. L. Holladay
Holladay & Westcott
Los Angeles, Calif.

We Get Around

Sir:

We are a recently formed company of consulting engineers to the Iron & Steel and Allied Industries and find your publication of very great interest.

We would appreciate receiving your assistance in the following matters.

We would like to have some particulars (address, activities, membership requirements, etc.) of the American Institute of Consulting Engineers.

We found your report from India in the October, 1956 issue very pertinent and interesting. We would like to contact your correspondent, Mr. S. S. Pani, and therefore request you to send us his address.

R. D. Lalkaka
Project Engineer
M. N. Dastur & Company,
Private Ltd.
Calcutta, India

RELIANCE motor design proved in new paper mill

Here is a 100 hp. Reliance Totally-Protected A-c. Motor doing a job under very adverse conditions. The water and pulp being sprayed on it is coming from a paper board machine, part of an installation that Crossett Paper Company recently built to produce bleached kraft board from hardwood and pine pulp.

But there is more to a Reliance Motor than just a good enclosure. Extra copper and iron, the best bearing lubrication system, tough, resistant insulation . . . these and many more features add up to designed durability, the one big feature that makes users, like Crossett, steady Reliance customers.

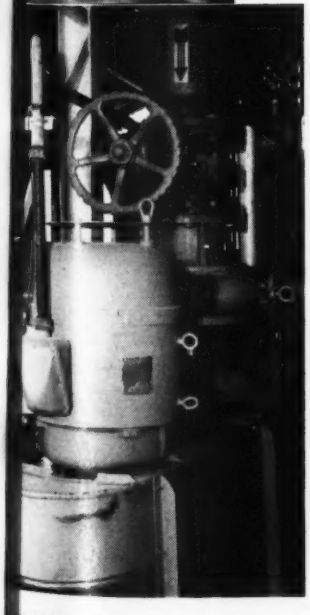
Call your Reliance representative and ask him to show you the Reliance extras. Fifteen minutes of your time now can save hours of machine down-time later.

For further details on this installation, write for bulletin B-2504. B-1535

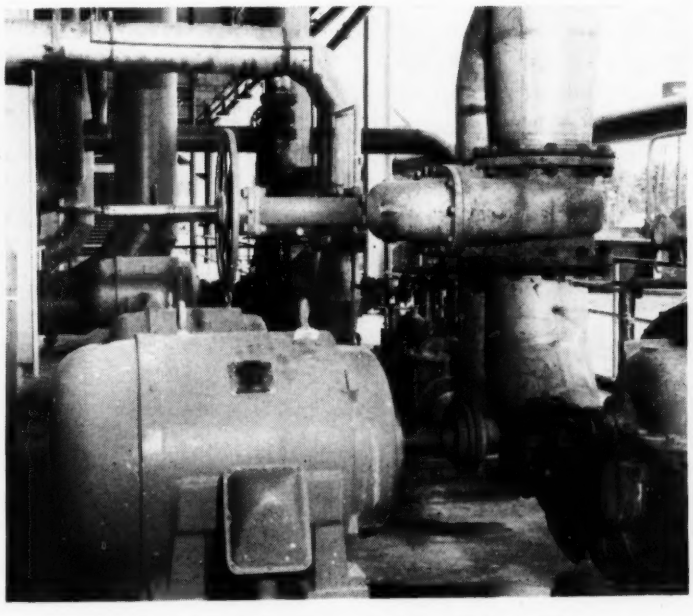
RELIANCE ELECTRIC AND ENGINEERING CO.

DEPT. 331A, CLEVELAND 10, OHIO • CANADIAN DIVISION: WELLAND, ONTARIO
Sales Offices and Distributors in Principal Cities

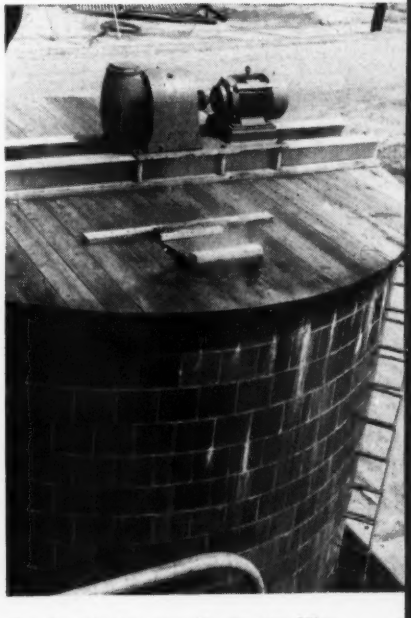
◀ Located under the head end of the board machine, this 100 hp. Reliance A-c. Motor operates a fan pump while periodically being drenched with water and pulp.



Reliance has frame designs for every application. Here is a 25 hp. foot mounted vertical motor driving a refined-stock pump. Other vertical designs include C-Face, D-Flange, and P-Base mountings.



This 60 hp., 1800 rpm and two 40 hp. 900 rpm Reliance A-c. Motors run white water pumps. Though reasonably sheltered from the elements, the motors are subjected to wide temperature changes.



In hard to reach spots like this two story high refined stock chest, Metermatic Bearing lubrication is very important. This new line 20 hp. Reliance A-c. Motor will operate the agitator for months without greasing.

Scraps & Shavings

EVERY ASSOCIATION of consulting engineers has among its plans some sort of program of public relations. The fact that even the practitioners of that art are not able to define it gives some excuse for engineers failing to agree on just what should be done, but it seems that the target should be better defined.

Public relations in behalf of manufacturers of horseshoes is different from public relations done for electric utilities. The horseshoe manufacturer's public is limited to that portion of the population who deal with horseshoes, or horses, or who live within the environment of horseshoe manufacturing plants. To sell the public in general on the importance of horseshoes would be a waste of time and money. The public utilities, on the other hand, must aim their promotional and public relations efforts at the whole population.

Consulting engineers are somewhat in the position of horseshoe manufacturers. They come in contact with only a small part of the people. The average man never builds a factory, a power plant, an office building, a bridge, or a school. Even public construction is of little concern to the public, since contact is through public officials or civil servants.

There are exceptions to this limitation. For example, it was necessary for the consulting engineers in California to try recently to reach all of the voters in connection with a proposed change to a constitutional amendment that directly affected engineers. It is rare, however, that the whole public is involved in any activity primarily concerning consulting engineers. Even in most matters of legislation the successful approach is directly to the legislature rather than to the people.

Because of this limited field of contact of consulting engineers, it is foolish to talk of public relations with reference to the whole public. It would be pleasant if every man on the subway knew all about consulting engineers, but it would have little effect on the consultant's income or his professional position. And public relations is not supposed to be eleemosynary, it is supposed to pay off in U. S. dollars. To make it pay off it must be directed to that part of the public that makes use of the services of consulting engineers. This consists of architects, manufacturers, real estate promoters, and government bodies. The rest of the public may well follow Mr. Vanderbilt's suggestion.

When it is recognized that the portion of the public that must be sold on the value of the consulting engineer is relatively small, the public relations job seems more practical. It does not cost as much to sell a small group as it does to sell the whole country, and the value received is measured more readily.

All too often consulting engineers have the feeling that a public relations program means favorable articles in the newspapers, prominent mention in the national general circulation magazines, and proper recognition on television and radio. While those broadsides no doubt are helpful to prestige, they cost a great deal more than they return. The manufacturer of surgical instruments does not advertise in the *Saturday Evening Post* even though a number of surgeons read it. There are too many *Post* readers who are not surgeons. The sensible place for him to advertise is in a journal going to surgeons. It is more logical to go deer hunting with a rifle than to bomb the forest in which the deer run.

Consulting engineer associations cannot afford to scatter-bomb the country with their story. They must become expert riflemen and pick off their quarry. Aim at architects and potential clients.

Manufacturers are the largest of the groups that count who still do not understand the functions of the consulting engineer. They are the men who build the industrial plants, large and small. They need a lot of selling. Many of them still depend on their central engineering departments for new construction designs and specifications. Yet central engineering departments are called upon for major project designs only rarely, and they cannot offer the vast experience of a consulting firm. They are also under constant pressure to specify equipment manufactured by a customer or friend of their firm rather than that best suited to the particular application. They cannot do the job as well or as inexpensively as a consulting engineer. This should be explained to management.

Here, then, is a definite target, an opportunity to shoot from position No. 1. Consulting engineers should aim carefully and fire. ▲▲

Architects, Engineers and Contractors prefer

ALLENCO

Here are a few recently completed installations:

Where	What	Specifier	Installer	Fieldman
Springfield, Mass.	Junior High School	Maloney & Tessier	A. E. Stephens Co.	Harold Jope
West Hartford, Conn.	Junior High School	Nichols & Butterfield	Wadhams & May Co.	Harold Jope
Cincinnati, Ohio	Washington Park Elem. School	A. M. Kinney	B. A. Walterman Co.	Dick Disney
Ann Arbor, Mich.	University of Mich. Library	Albert Kahn Assoc.	Dunbar-Borton	Russ Collins
Portland, Ore.	Woodrow Wilson High School	Tom E. Taylor	A. G. Rushlight Co.	Dick Finklea
Salem, Ore.	South Salem High School	Tom E. Taylor	Vern Collins Plbg. Co.	Dick Finklea
Salt Lake City, Utah	Latter-Day Saints Church	Owner	Owner	Nic Nicodemus
New Orleans, La.	St. Martin's School	James M. Todd & Assoc.	Frank A. Dorsa	Bob Barnes
Pullman, Wash.	Women's Residence, W. S. C.	James B. Natkin	Senna Service, Inc.	Stan Schafer
Moscow, Idaho	University of Idaho Library	Whitehouse, Price, DeNeff & Geeble	Detweiler Bros.	Stan Schafer
Minneapolis, Minn.	Zion Lutheran Church	Thorsov & Cerney, Inc.	Dean L. Witcher, Inc.	Art Narverud
St. Louis Park, Minn.	Cathedral High School	Louis C. Pinault	Roel Construction Co.	Art Narverud
LaFayette, Ind.	Purdue University Dorms	Walter Scholer	Freyn Bros.	Don Davisson
Bloomington, Ind.	I. U. Medical Science Building	Ammerman, Davis & Stout	Hayes Bros.	Don Davisson
Fairview Park, Ohio	High School	Fulton, Krinsky & DelaMotte	Gorman-Lavelle P & H	Jerry Sullivan
Gates Mills, Ohio	St. Francis of Assisi Church	Horn & Rinehart, Archs. P. B. Fleming, C. Engr.	Gorman-Lavelle P & H	Jerry Sullivan
Pittsburgh, Pa.	High School	Celli & Flinn	John Kennelly	Wm. Negle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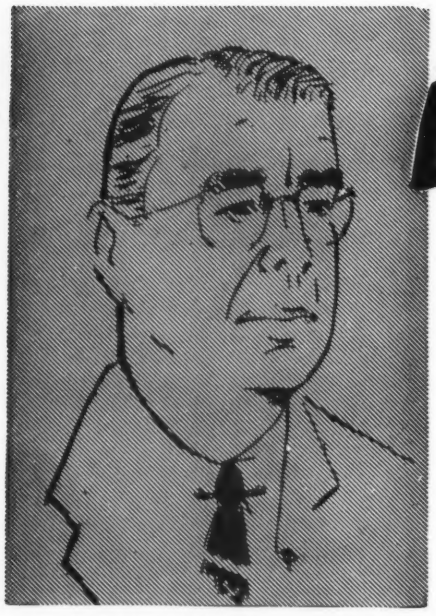


Economic News Notes

E. F. MacDonald
INDUSTRIAL ECONOMIST

BILLIONS, NOT MILLIONS — The only way local governments will be able to catch up with needed construction of public works by 1964 is by doubling the current volume of outlays — by spending $20.4 billion annually. Maj. Gen. J. S. Bragdon, special assistant to the President on public works, added in a recent speech that public works needs of local governments now amount to over $200 billion. Of this, highway requirements account for $92 billion, schools $41.5 billion, and water and sewerage facilities $25.3 billion. With respect to the latter, the General pointed out that one out of every eight cities today faces a water shortage.

DAZZLING SIXTIES — A spectacular boom for the construction industry is the prospect seen in a study by economist Miles Colean published in last month's Architectural Forum. By 1966 he sees the annual volume of new construction up to the $64 billion mark — 45% greater than 1956's record $44 billion. "Tied to an expanding economy, with the promise of strong gains in population, production, and income, building prospects over the next decade are not just bright, but dazzling."

DIFFERENT SLANT — In the midst of all the talk about the hectic capital-spending boom, it might be well to step back and look at it from another angle. The relative importance of business outlays for new industrial and commercial construction and for durable equipment hasn't changed very much over the past six years. In 1956 such expenditures amounted to about 9.8% of the nation's total output of goods and services; in 1950 it was 9.4%. However, the 1956 percentage was considerably higher than the 5.9% of 1939 and the 7.2% of 1929.

TAX-EXEMPTS — Speaking of multi-billion dollar construction needs raises the question of how state and local governments will raise such stupendous sums of money. Taxes are already high, it is charged, and the municipal bond market had indigestion last year in trying to equate demand and supply. Currently, attention is again focused on earlier suggestions that shareholders of investment companies that invest in tax-exempt securities be permitted by law to receive tax-free the interest on such bonds. It is argued that this would tend to broaden the market for bonds of state and local governments.

GOOD CHANCE — Stating that he thought "the prospects are very good" for passage of a Federal school construction aid bill by the present Congress, Mr. Marion B. Folsom, Secretary of Health, Education, and Welfare, has pointed out that both parties had signified their support for such aid during last fall's campaign. The Secretary added in a recent interview that with respect to the method of apportioning funds, the President "feels quite strongly" in favor of distributing funds on the basis of need.

LEASED CONSTRUCTION — In the past three and one-half years, up to October 1956, the Post Office Department has arranged for the construction of about 1300 new buildings — financed by private funds. These were then leased by the Government. This represents "just a start" Mr. O. A. Kieb, Assistant Postmaster General, states in a recent publication, "Post Office Department Real Estate Operations." He points out that "on the average, over two agreements for leasing new postal buildings are now being signed every working day . . . In order to meet our nominal needs the rate must reach three agreements per working day within a few months."

WORK AHEAD — Outlays totaling $22 billion will be required for installation of new sewerage systems by 1975 in order to meet the needs of the nation's growing population and to replace obsolescent facilities. This estimate and detailed discussion are found in a report, "Summary of Information on Public Sewerage Systems — Capital Investment Values," published by U. S. Department of Commerce.

THROUGH THE TRANSIT — Construction outlays in 1957 planned by one company, AT&T, will total $2.5 billion — repeat billion — $300 million more than in 1956 . . . Except for a 7-mile section, the 236-mile, 4-lane Kansas Turnpike was paved in one construction season . . . A survey by AGC's Education Committee discloses that the 6700 members will need 13,000 additional civil engineers in three years and 20,000 in the next five years . . . Growth: In 1932, its first year of operation, the George Washington Bridge had a traffic of 5.5 million vehicles; in 1955 — 35.8 million . . . Civil engineering grads are estimated to have increased from 4400 in 1954-55 to 6000 in 1956-57 . . . The Engineering Societies Library in the Engineering Societies Bldg. in NYC receives over 1400 periodicals a year. ▲▲

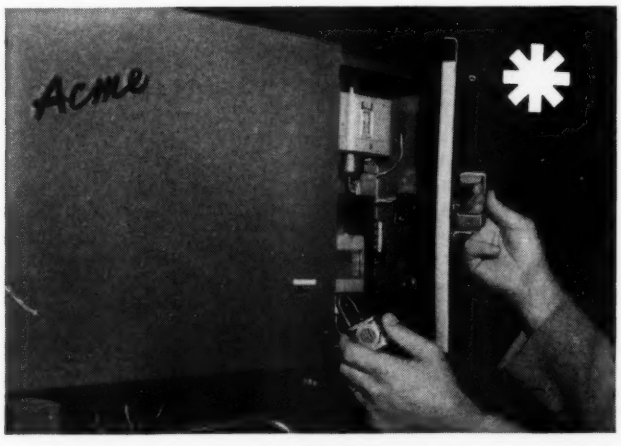
SMALL TONNAGE LIQUID CHILLER

...the Acme FLOW-COLD®

It's Flow-Cold again for '57 – the most advanced, most specified line of packaged chillers in the 3 thru 20-ton range. Whether you're an engineer requiring the best in design and construction, or a contractor looking for ease of installation and trouble-free operation, there are good reasons for heading your chiller specifications with "Acme Flow-Cold."

The Flow-Cold's components – Dry-Ex® chiller, condenser, heat exchanger and super quiet, accessible-type, hermetic compressor – are tops for advanced engineering . . . proven performers! Flow-Cold chillers are *complete* packages . . . all piping and wiring factory-installed and tested *in operation*. All necessary controls are furnished . . . now fully enclosed to stop unauthorized tampering. And Flow-Cold chillers are not only factory tested, they're *certified* . . . a "first" among chiller manufacturers.

Now add the Flow-Cold's newly streamlined wiring and piping, neat, preformed pipe insulation and the inherent compactness of Acme's Flow-Cold design . . . and you have a chiller that's just as *good looking* in an installation as it is efficient and economical to operate.

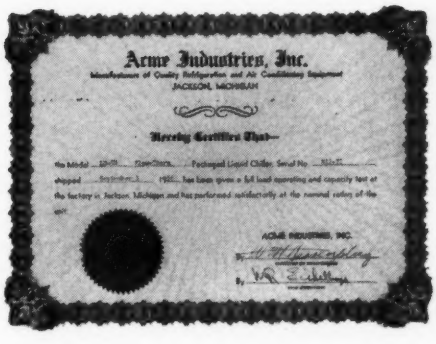


NOW TAMPER-PROOF

Ever experience the damage to a system from control "adjustments" by inexperienced personnel after a job is installed? The Flow-Cold's new enclosed control box can be locked to "foil the fiddle fingers" and keep servicing in the hands of the men who know how.

AND TEST-CERTIFIED

Proof of seven factory test procedures conducted under full load, Acme's Certificate of Performance guarantees contractors of ready-to-go dependability for every Flow-Cold shipped from Acme.


Acme Industries, Inc.
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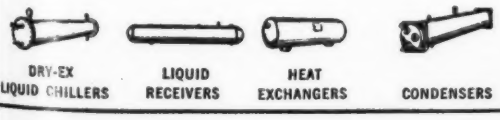
Hereby Certifies That—

For advanced packaged chiller engineering in other capacities, investigate the Acme Flow-Therm, 20 thru 300 tons, and the Flow-Pac, 1¾ thru 5 hp.


DRY-EX LIQUID CHILLERS | LIQUID RECEIVERS | HEAT EXCHANGERS | CONDENSERS

Clip this coupon and attach to your letterhead to receive your new Acme Flow-Cold Catalog.

ATOMS IN ACTION

WORK HAS STARTED at AEC's Hanford Plant on a research program aimed at enriching natural uranium with plutonium as a fuel for power reactors. At present, power reactors depend on enriched natural uranium for fuel, and plutonium has found use only in manufacture of atomic weapons. General Electric will conduct the research for AEC.

THE ATOMIC INDUSTRIAL FORUM meeting on the insurance problem, to be held at the Plaza Hotel, New York City, January 21 and 22, will be focused on the evaluation and discussion of the final report of the Forum-sponsored Columbia University study on "Financial Protection Against Atomic Hazards." Insurance activities in Britain and Europe also will be reviewed.

BASED ON EXPERIENCE gained on AEC's Savannah River reactors in which heavy water is used as moderator and primary coolant, the AEC has asked E. I. du Pont de Nemours & Co. to undertake a design study and development work to determine feasibility and economics of heavy water moderated reactors for electric power generation. The study will include use of natural uranium as fuel. This will be the U. S.'s tenth approach to economical atomic power.

THE H. K. FERGUSON CO., of Cleveland, Ohio, has the architect-engineer contract for the Experimental Breeder Reactor II, to be built at AEC's Arco, Idaho, Test Site. The sodium cooled EBR-II will produce 62,500 thermal and 20,000 electrical kw.

DESIGN and supervision of construction of facilities such as towers, bunkers, and instrumentation stations at AEC's Nevada Test Site will be performed by Holmes & Narver, Inc., of Los Angeles, Calif. Burns & McDonnell Engineering Co., of Kansas City, Mo., is architect-engineer for the new technical area at the Test Site.

CURTISS-WRIGHT CORP. has filed an application with AEC for a license to construct and operate a light water moderated, pool type reactor designed to operate at 1000 kw, to be located at its Research and Development Center, at Quehanna, Pa. Ralph M. Parsons Co. will be architect-engineer for the facility, with Daystrom, Inc. as the reactor builder. Curtiss-Wright plans to use the reactor for design and development of nuclear propulsion systems for aircraft and for shipboard and stationary power plants, among other things.

ARCHITECT-ENGINEER for construction of weapons engineering facilities for the Livermore, Calif., branch of Sandia Corp. is Sverdrup & Parcel, of St. Louis, Mo.

WESTINGHOUSE scientists have developed a technique to study the complicated stresses existing inside the solid steel pressure vessel of a power-producing nuclear reactor. An exact model of the vessel is built from a photoelastic resin, recently developed. The model is subjected to stresses proportionate to those in its prototype. Samples cut from the model and examined under polarized light show the stresses as patterns of colored light. Although the technique itself is not new this is the first time such a large-scale test has been run. The model is 2 ft high, $1\frac{1}{2}$ ft in diameter, and weighs about 100 lb.

THE AMERICAN SOCIETY FOR TESTING Materials has formed a subcommittee to study effect of nuclear and high energy radiation on properties of plastics and electrical insulation. Chairman is D. S. Ballentine, of Brookhaven National Laboratory.

NEW ENGLAND ELECTRIC SYSTEM has announced plans to construct an atomic power plant with a capacity of 200,000 kw or more, to be put in service by 1963 or 1964. Studies are under way to determine the best type, size, and location. New England Electric is a member of Yankee Atomic Electric Co., the group that plans to complete by 1960 a 134,000 electrical kw pressurized water plant at Rowe, Mass.

ACCORDING TO E. I. FARLEY, vice president of the insurance brokerage firm of Marsh & McLennan, all three of the insurance syndicates formed to cover nuclear risks are accepting applications for insurance. The two syndicates concerned with property damage are issuing property damage binders subject to insuring conditions and to rates to be published in the near future. Also in the insurance field, Brookhaven National Laboratory has a study in preparation of realistic dollar figures for possible costs of reactor accidents. Requested by the Joint Congressional Committee on Atomic Energy, through AEC, the report will cover existing information and lack of information in the insurance field.

LETHAL DOSES of radiation show promise in the treatment of leukemia, according to Dr. Leon Jacobson of the University of Chicago and Dr. John F. Loutit of Britain's research center at Harwell. Patient recovery from the heavy radiation dose would be accomplished by bone marrow injection.

THE MARITIME ADMINISTRATION has invited proposals for production of a closed-cycle gas turbine merchant ship propulsion plant that can be used with a conventional oil fired heat source, yet will be applicable in conjunction with a nuclear reactor.

TESTING and INSPECTION at Pittsburgh Piping

Fluorescent-penetrant examination detects surface defects. Pipe exterior is painted with fluorescent-fluid, then dusted with powder which draws fluid to surface where it is observed under ultra-violet light.

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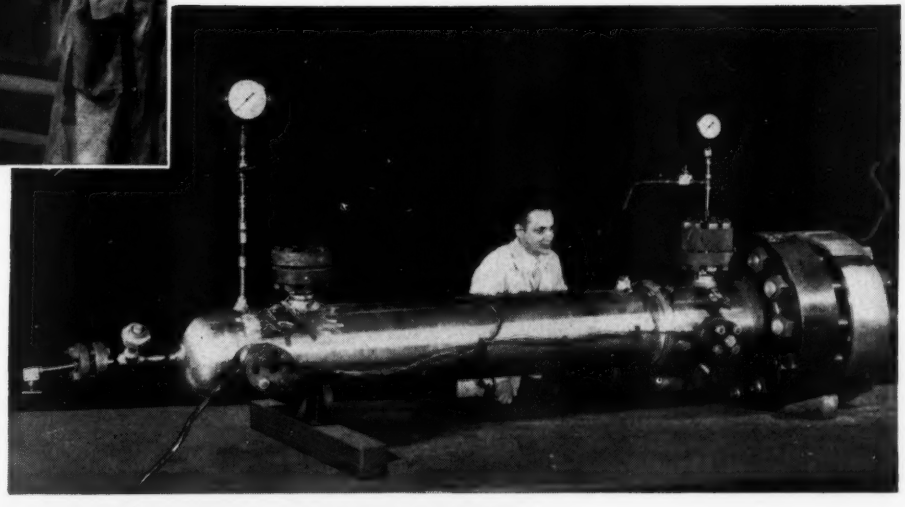
Fabricated chrome-moly header for central station piping system.

This testing instrument transmits ultra-sonic waves into pipe wall, with their movement around the pipe being indicated as a consistent pattern on the instrument's screen. Any internal defect in the pipe wall reflects the waves back to the instrument more quickly and is thereby revealed on the screen.

Close quality control is maintained throughout the fabricating process at Pittsburgh Piping by means of almost a score of different types of tests and examinations — three of which are shown on this page. Our technical staff supervises these procedures — checks all materials and production operations. This activity assures that each component, assembly, and the final piping system fabricated and erected by Pittsburgh Piping meets code and insurance requirements . . . fills the customer's specifications . . . and gives trouble-free service.



Hydrostatic testing at Pittsburgh Piping. This stainless steel surge tank is being tested at pressure up to 5,600 psi. Strain gauges are used to check closely for plastic deformation.

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Toronto	68 Yonge Street

The Legal Aspect

MELVIN NORD, P.E.
Consultant in Legal and Technical Problems
Patent Attorney

The Law of Corporations

PRINCIPAL REASONS for the popularity of corporate practice are: the ease of raising capital (through the issuance of stocks and bonds), the limited liability of the owners of the business, the perpetual life of the firm if desired (as contrasted with termination of a partnership upon the death of a partner), and the relatively limited powers of the members of the firm to bind the firm contractually (as contrasted to partners, who each have the powers of a general agent).

Ease of Raising Capital

There are a number of reasons why it is easier to raise capital in a corporation than in a partnership, but the principal one is that the liability of the investors is limited to the amount of their investment. If the business fails, the investor cannot, in general, be called upon to make up the corporation's deficits. Substantially the only exceptions to this rule (and they are apparent, rather than real exceptions) are: (1) the stockholder must pay up any unpaid stock subscriptions, and (2) if he has received any unlawful dividends (i.e. out of capital instead of out of surplus) he must return them to the corporation.

Another reason why it is easier (i.e. less painful) for a corporation to raise funds than for a partnership to do so, is that in a corporation the investor does not obtain a direct voice in the management of the business itself.

Thus, when the use of a large amount of capital is vital, there is practically no choice but to form a corporation. In engineering practice of certain types, i.e. where engineering services are combined with another service (research, development, or construction) big money is needed. However, in most engineering practice this is not so, and the partnership form of business is more natural. When capital is raised in the corporate form of business a "price" must be paid in the form of restrictions on the mode of conducting the business, as well as stricter government regulations and usually higher taxes.

Limited Partnerships

It should also be pointed out that there is an in-between form of business recognized in most states — the limited partnership. The distinguishing characteristic is that one or more special partners contribute capital without assuming personal liability or obtaining a direct voice in the management of the business. The other (general) partners have the same powers and liabilities as in an ordinary partnership. In order to set up a limited partnership (as opposed to an ordinary partnership), it is necessary to file a sworn certificate showing the details of the partnership arrangement.

The alternative possibility for a partnership that needs money more or less permanently in its business is to borrow it. This is disadvantageous, however, since it restricts the firm's credit. On the other hand, taking in a special partner increases the firm's credit, since it adds ownership funds, which are subordinated to the rights of creditors.

In engineering practice where it is necessary to raise a modest sum of money, the limited partnership thus represents a desirable compromise.

Corporate Stocks and Bonds

The same problem as to whether to borrow or to take in other investors also exists in corporate financing. If investors are to be taken in, they are given shares of stock in the corporation, thus giving

them a right to share in the profits. They also usually have the right to vote in shareholders' meetings (primarily to elect the board of directors).

On the other hand, if money is borrowed on a long-term basis, corporate bonds are given as evidence of the indebtedness. The bondholders are entitled to the return of their money over a prescribed period, with whatever rate of interest has been fixed. They have no vote or voice in the management of the business, except to the extent provided in the bonds. However, the bonds are usually secured by a mortgage on the corporate assets, and failure to repay the debt may therefore result in foreclosure of the mortgage and consequent termination of the business activities. Normally this cannot happen if an investor fails to receive dividends, since he is not a creditor or mortgagee.

In general, a balanced corporation will have a proper blend of stocks and bonds outstanding. If the bonded indebtedness is excessive, the corporation's credit will be poor. But if the original owners of the corporation take in too many additional stockholders in order to maintain a high credit rating, they will be splitting their profits excessively. Thus, obtaining money through the issuance of excessive amounts of stock is too expensive a way of raising money.

Variations in Corporate Financing

In-between positions also exist in the corporate form of doing business. A bondholder may have an option to convert to stock in certain instances, or he may have share warrants (i.e. options to purchase stock at a set price). In this case he is a creditor, but he has an option to become a part owner.

On the other hand, a preferred shareholder may in some respects more closely resemble a creditor than an owner. Normally he has no voting rights (although he may

get them under certain conditions, if so provided in his stock certificate). And he is entitled to receive a preferred dividend (i.e. before any common stock dividends) that is equal to a specified percentage on his investment. While this sounds like interest, it is not because it is not payable except if dividends are declared. If there is no surplus, the preferred dividends will have to be passed up, while interest on an indebtedness must be paid regardless. There are some other variations with respect to preferred stock, but this will suffice to illustrate its in-between nature.

Powers of Corporation Members

The board of directors (acting as a group, and not individually) is elected by the stockholders to manage the corporation's business. The day-to-day operations are conducted by officers (e.g. president, vice president, secretary, and treasurer) who are appointed by the board of directors. The stockholders' voices are made effective through their vote at stockholders' meetings for directors and on other major questions, such as merger or liquidation.

The directors are not agents in the technical sense, but they nevertheless have a fiduciary duty to the corporation. That is to say, they must act in good faith and with reasonable diligence and care. They are not permitted to make a secret profit at the expense of the corporation or its stockholders (although there are some limitations to this as a general proposition). The officers are true agents of the corporation, but no one of them has as much authority to bind the firm as a partner has in a partnership.

Limitations

Certain kinds of business are precluded by statute from incorporating. Among these are the "learned professions" of law and medicine. While engineering is not in the same legal boat, many state registration laws interfere

in one way or another with the corporate practice of engineering. A common provision requires that all officers and directors of an engineering corporation be registered engineers. This is not always feasible, for the large stockholders who want representation on the board are more likely to be lawyers, accountants, or financiers, rather than engineers.

The same provision is frequently made as regards partners, in the case of engineering partnerships. Presumably this applies also to special partners in the case of limited partnerships.

The law on this point is undoubtedly in an unsatisfactory state. At the very least, it would seem that special partners in limited partnerships should not require registration, since they are more like stockholders than like directors or general partners.

Take Your Pick

By now, it should be clear that the answer to the question of which type of firm to organize is: "It all depends . . ." ▲▲

Consulting engineers are now specifying these I-T-E Current-Limiting "Cordon" Circuit Breakers.

Immediate delivery can be made on all four frame sizes, for 600 v a-c and 250 v d-c service, 15 to 600 amperes.

I-T-E

Notes From Abroad

Building Stone

Walls that will withstand high bending and compression stresses can be constructed with a new type of building stone developed by an Austrian manufacturer. Called Czero, the hollow stones have grooves on their vertical faces with a swallowtail-shaped cross section. These grooves can be filled with finely ground concrete, cement, or similar materials to form a continuous pillar shaped reinforcement. This reinforcement makes it possible to construct buildings up to four stories in height without additional steel reinforcement.

If very high pressure and tensile strength are necessary, steel rods can be drawn through the grooves, which are then filled with ground concrete. In the same manner, horizontal irons and clamps can be inserted. This type of reinforcement makes it unnecessary to lay the stone "joint on full." Laying the stones "joint on joint," the use of half stones is unnecessary at corners and ends of walls.

New Plans for Caspian Sea

At the Caspian Sea Conference in Astrakhan, the proposed diversion of northern rivers into the Caspian was opposed and a new project outlined. Object would be to raise the sea level in the Caspian only in those parts where it was most needed. To do this a 279-mile long dam would be constructed from the western shores to the island of Kulaly in the eastern section. Such a dam would raise the water level to the north of the dam from its present depth of 11.5 ft to a depth of 16.7 ft within two years of its construction. The dam would be breached by locks for navigation and passages for fish. Aim is to convert the northern Caspian to a fresh water lake for use in irrigating the desert coastal areas of Kazakstan.

Keeping up to Date

The Scientific Information Institute, set up three years ago by the U.S.S.R. Academy of Sciences, began publication of four new periodicals in 1956; on mechanical and electrical engineering, metallurgy, and geology. Plans are to expand the list to include civil engineering and mining. The books cover engineering and scientific developments throughout the world. Aim of the Institute is to process some 9000 foreign periodicals, digest the material, and republish it in Russian.

Other projects include publication of the technical bulletin "Express Information" which contains photographs, diagrams, and text from foreign and national sources on 21 branches of technology. Special services of the Institute have included surveys on the latest developments in science and technology, and preparation of microfilms and photostatic copies of scientific treatises.

The more than 1500 translators working for the Institute have proved inadequate for the work load, so the Academy of Sciences has promised to develop translating machines to mechanize operation. The Besson rapid computer has been used experimentally with some success.

Bridge for Tasmania

The Tasmanian government has appointed G. Maunsell and Partners, of London, as consulting engineers for design of a new bridge over the Derwent River at Hobart to replace the floating arch bridge now in use. Appointment covers the design, plan preparation, calling for tenders, and supervision of construction.

Engineer Shortage in Australia

A survey conducted by the Association of Engineers, of Australia, brought out the fact that the number of men training as engineers is only about 9 per 100,000 of population in Australia as compared with 28 in Russia and 14 in the U.S. To maintain present technical progress, the Association estimates that the 900 engineering students graduating each year from Australian universities must be increased to 2000 per year in the shortest possible time.

Natural Gas Line

As part of the 3000-mile natural gas pipeline in British Columbia, a 688-mile line, owned by Westcoast Transmission Co., will bring gas from Peace River to the U.S. —Canadian border at Huntingdon, 30 miles east of Vancouver. From this point, under a 20-year agreement, Pacific Northwest Pipeline Corp. will pipe the gas to principal centers in the northwestern United States.

Westcoast daily flow will be 400-million cu ft, with a projected daily flow of 660-million cu ft. Pacific Northwest has contracted for 300-million cu ft per day. Remainder of the volume will be used by British Columbia.

Advisory engineers on the compressor stations are Ford, Bacon and Davis, Inc., of New York. Construction agents are Canadian Bechtel Ltd., branch of Bechtel Corp., of San Francisco.

Dock Modernization

The Quai du Maroc dock, part of the scheme to improve the harbor at Marseilles, France, is scheduled for completion during the last of 1957. Running north and south, the 2800-ft dock, with its 33-ft foundation, will provide modern facilities for large ships.

The northern part of the dock, 1500 feet of which have been in service for over a year, is equipped with a hanger 720-ft long and 154-ft deep, with a passageway for passengers. The southern part of the dock will be similarly outfitted,

One of a series appearing in **FORTUNE, NEWSWEEK, TIME, BUSINESS WEEK** *and leading architectural magazines.*

puzzlement

What happened to the hole in Lewin-Mathes Tube?

It's been eliminated in *part* of our production . . . so that users of Brass Rod can now enjoy the same standard of quality and service which has been responsible for the popularity of Lewin-Mathes Copper and Brass Tube and Pipe during the past 25 years.

In designing America's most modern Brass Rod mill, Lewin-Mathes has pioneered new automatic production and testing methods . . . adding even greater efficiency to our already *completely integrated* plant.

Now more than ever, specifying uniformly perfect Tube, Pipe and Rod is no puzzlement. Simply remember Lewin-Mathes—the *integrated specialist!*

LEWIN MATHES

SAINT LOUIS, MISSOURI

MANUFACTURERS OF
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with covered passageways running from the edge of the dock to the storage space behind.

A new dry dock, 820-ft long, 138-ft wide, and 36-ft deep to the keel locks, will have the most modern equipment, including a truck elevator.

Tiny Industrial TV

A television camera developed in Germany by Prof. Dr. Ing. Walter Heimann for supervision of industrial processes utilizes a transmission pickup tube only 3½ in. in length and ½ in. in diameter, with lenses of the type used in 8-mm movie cameras. The entire television appliance is about the size of an electric light bulb.

Trans-Atlantic Cable

The trans-Atlantic submarine cable, put into operation in September by Canadian Overseas Telecommunication Corp., the British Post Office, and American Telephone and Telegraph Co., provides Canada with six telephone circuits, and additional telegraph channels between Canada and the United Kingdom. The telegraph channels are part of an overseas customer to customer teleprinter service throughout the United Kingdom and the European continent.

The trans-Atlantic section of the cable system, consisting of twin submarine cables, extends 1950 nautical miles between Clarenville, Newfoundland, and Oban, Scotland. A single cable carries the circuits 300 miles west from Clarenville across Newfoundland, through the waters of Fortune Bay, to the mainland of Canada at Sydney Mines, Nova Scotia. Here a microwave radio relay route takes over for the 575-mile stretch to Portland, Maine, where the system connects with the U. S. Bell system.

Translucent Panels

Polyester resins and glass wool have been combined by a Viennese firm to produce a building material suitable for construction and decorative purposes. Known as Polestit, the material has high tensile and bending strength (1,170 and 17,800 psi) and a light transmission of 80 to 85 percent.

It is suitable for walls, roofs, and illuminated advertisements. Supplied either as smooth or corrugated board in various colors, it is highly resistant to weather, solvents, acids, carbon dioxide, and temperature changes.

Indian Heavy Water Project

Vitro Engineering Division of Vitro Engineering Corp., New York City, will work as technical consultants on the project to produce heavy water and fertilizers at Nangal, India, site of the Bhakra-Nangal hydroelectric plant now under construction.

Vitro was chosen on the basis of its preliminary project reports and the fact that it is the only firm capable of setting up a heavy water plant based on the catalytic process. The hydrogen distillation process, less costly and more productive, is still in the testing stage. If these tests are satisfactory, the new process will be installed. In either event, Vitro will act as consultants on the project.

If the catalytic exchange process is adopted, Vitro will receive about $160,000; if hydrogen distillation is used, the fee will be about $125,000.

The plant will produce 7½ tons of heavy water a year, in addition to 200,000 tons of ammonium nitrate. The 160,000 kwh necessary to operate the plant will be supplied by the Bhakra power plant.

Materials Handling Island

A man-made island will be built by SAROM (Societa Arionaria Raffinazioni Oli Minerali) four to five miles from the coast of Ravenna, Italy, for the purpose of transferring mineral oil from tankers to a hydrogenation plant in Ravenna. The town lacks suitable wharf facilities for large tankers.

The island platform will rest on 36 steel pillars, each 111-ft long, and will be fitted with a crane with a 63-ft arm. The crane will handle flexible steel tubes for discharging oil from the tankers. The oil will be pumped through a nine-mile long pipeline from the island to the refinery.

Feeder Service Airports

The West German state of Baden-Wuerttemberg plans to

This Whiting Crane at Continental quickly carries heavy coils of wire from storage to production —keeping machines busy without jam-up.

How Continental Steel's "special" cranes pay off!

Continental Steel Corporation, Kokomo, Indiana, depends on three "special" Whiting Cranes to keep production flowing fast. Two of them are 5-ton overhead cranes used to spot coils of wire accurately at automatic wire welding machines, then move the finished reinforcing fabric to shipping or storage. The third Whiting Crane is a low profile gantry with floor level hoisting drive. It moves all production in Continental's pickling department and has played an important part in increasing the company's wire production by nearly 50%. These cranes — like all Whiting Cranes — are "special" because each is custom engineered to do a specific job, day in and day out, with a minimum of maintenance.

WHITING CORPORATION, 15620 Lathrop Avenue, Harvey, Illinois

SEND FOR THIS REPORT!

An illustrated 6-page case study, "Custom Built Whiting Cranes for Continental Steel Corporation" tells how these cranes were engineered to solve special problems. Write for a copy today.

MANUFACTURERS OF CRANES, TRAMBEAM HANDLING SYSTEMS, TRACKMOBILES, FOUNDRY, RAILROAD AND CHEMICAL PROCESSING EQUIPMENT

build several special airports and landing strips for helicopters and light planes to serve as a feeder service for the international airport in Stuttgart.

Wood-Cement Building Panels

A lightweight construction material based on a Swiss process is being manufactured by Metallbauwerke Wels Ges. m.b. H., of Wels, Austria. The material is produced from waste wood splinters mineralized by a chemical treatment, and combined with cement. The wood-cement plaster can be pressed into blocks or slabs of any size. It can be sawed, drilled, or chopped. It is porous, heat insulating, and soundproof. Because of the cement, the material is resistant to dampness, smoke, and rot, as well as to destruction by insects and mold. Tests indicate that it is also fire resistant.

Construction of cavity brick walls is effected by filling hollow blocks of this material with concrete. Weight of the wall is supported by the concrete core. In Switzerland, four-story buildings with 20-cm (7.8-in.) thick basement walls, and 12-story buildings with 30-cm (11.8-in.) thick walls in the lower stories have been constructed successfully.

Roof plate manufactured of this material can be walked on immediately after installation. The under side is reinforced with steel and the top with a layer of pressed cement plaster.

Pakistan Paper Mill

Annual capacity of the $20 million paper mill to be built for the Pakistan Industrial Development Corp. will be 23,000 tons of newsprint and 12,000 tons of mechanical printing paper. Located at the delta of the Ganges River, near Khulna in eastern Pakistan, the mill will use Gewa wood (a species of poplar) from the nearby Sunderbans forest, which borders on the Bay of Bengal. Construction will start in March.

General consultants for the project are Sandwell & Company, Ltd., Vancouver, Canada. The Vancouver firm of T & H Engineering and Forestry, Ltd. will be responsible for forest surveys and logging plans. ▲▲

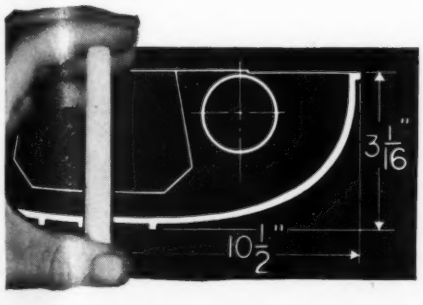
LIGHTING goes to School!

Now there's an even greater freedom of choice when you specify BENJAMIN for school lighting! For finest possible lighting and relighting results, there's an extra-wide range of opportunity to meet school lighting requirements—with an eye to that all-important budget.

Choose from Benjamin Troffers, offering a complete line of recessed units with many wanted features. Or, flatter classrooms with the new Benjamin "CAPRI", representing the last word in modern, low-silhouette, low-brightness illumination. Altogether, there are a score of different Benjamin School Lighting units, each specifically designed to meet your requirements at lowest possible maintenance and operating costs.

Considering all these things, Benjamin School Lighting is your better lighting choice.

the New CAPRI for Lower Cost School Lighting!



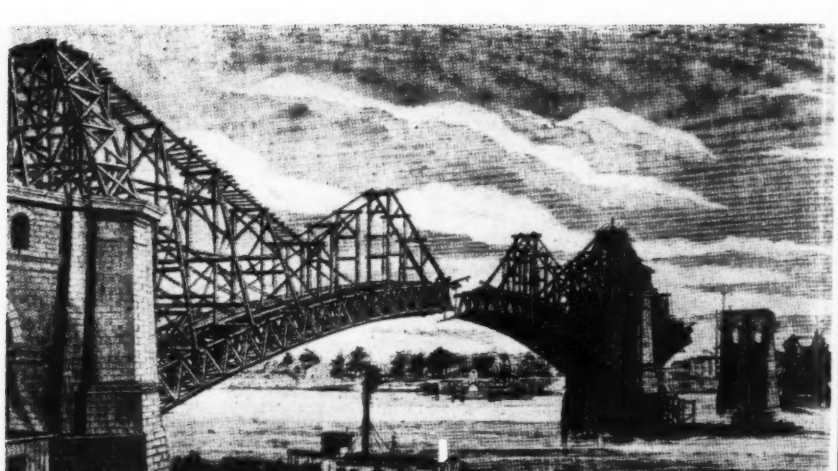
New Low Brightness! Now Benjamin brings you a new twin-lamp fluorescent unit that is shallower than a piece of chalk! Yet, the "CAPRI" meets all the requirements of the School Lighting Practice of the Illuminating Engineering Society.

New Low Silhouette! In a triumph of illuminating engineering, the "CAPRI" meets these standards even though it features the slimmest, trimmest proportions and the most petite, inconspicuous silhouette (3 1/16" high and 10½" wide) of any fluorescent school lighting unit! Modern, ultra-streamlined "CAPRI" units actually help improve the appearance of school lighting jobs to an extent never before accomplished at such small cost.

New Low Price! The "CAPRI" triumphs over high school lighting costs, too! Despite its modern appearance and engineering that meets IES Practice, it is one of the LOWEST PRICED pendent-type fluorescent units on the market today. Use it with 40-w Rapid Start or 96" Slimline lamps. Sliding hangers help you circumvent pipes and duct work. Unique air circulating vent at bottom of unit keeps dirt accumulation to a minimum. Benjamin Electric Mfg. Co., Des Plaines, Illinois.

1466R

Report from ST. LOUIS



STAFF

THE MISSOURI ASSOCIATION of Consulting Engineers scheduled their Annual Meeting this year for the night of Tuesday, November 27. On Monday morning we arrived in St. Louis, thinking that two days in the city would give us an opportunity to meet with many of the local engineers and discuss with them some of the problems of the profession.

Had lunch at the Athletic Club with Jack Harvie, Hueston Smith, Charlie Zurheide, and F. E. Wenger. Discussed difficulty of getting young graduates to go with consulting firms. The aircraft companies and other large industries treat young graduates as if they were star athletes being signed for the college team. They pick them up in planes and fly them to the West Coast for a week-end, throw big dinners for them, and generally treat them like millionaires at a charity ball. Consultants cannot compete.

These men also felt that all young graduates should spend a year or more on the drafting board, and they say that when the student hears that, he almost runs out of the interview into the arms of industry. We asked if all this emphasis on drafting was not the equivalent of asking a man to type all of his engineering reports. Not at all, they insisted. Instead, the engineer who cannot do his own drafting is like an artist who must stand back and tell an assistant where to put color on a canvas. It was agreed, however, that consultants are going to have to increase starting salaries to compete with industry.

Hueston Smith, who is chairman of the National Membership Committee of the Consulting Engineers Council, stated that he was astounded at the interest all over the country in the Council's work. He is in touch with about 25 groups now forming their own state or regional associations with the idea of affiliating with the Council. At least 10 are well under way locally. Smith said that the article on Errors and Omissions insurance published in the August issue of this magazine had resulted in a stack of letters "a foot high" addressed to the New York Association, who now have a group policy in effect. The Council took over the job of answering them and now has a committee working on a group policy for all the affiliated Associations. This activity alone, Smith said, will encourage formation of more state associations.

Water Supply Project

After lunch we were picked up by Messrs. Malowney and Griffin, of Ranney Method Water Supplies, Inc., and taken to Granite City, Ill., across the River, to see a water supply system they are installing for the Granite City Steel Company. The steel company had depended, heretofore, on four water collectors, of the Ranney type, to provide them with the 16-18 million gallons per day they needed for cooling water in the mills and the power plant. Now, however, the need for water has increased and the level of ground water in the area has dropped, so a new supply had to be found. They decided to run a pipe from the canal that runs around the Chain of Rocks reach in the Mississippi River, about four miles from the plant, rather than try to get the water by sinking more wells. The superintendent of utilities for Granite City Steel Company, A. C. Stoever, had the idea that the type of caisson used for the Ranney water collectors would make a good design for a canal intake, so he called in Ranney to handle the project. It turned out that Ranney had used their well caissons before for river intakes, so Stoever's idea was sound.

While the job was an interesting one, involving not only the intake and a pumping station at the canal but also three miles of 54-in. pipe running through Granite City itself, and a reservoir and pumping station at the plant, it did not require any unusual engineering design work. We had to admit to a bit of bewilderment as to just why it was so important that we should see the project.

It was the next day that we got the story — and an interesting story it was. We had lunch with Mr. A.

MODERN OIL AND GAS FIRED BOILERS

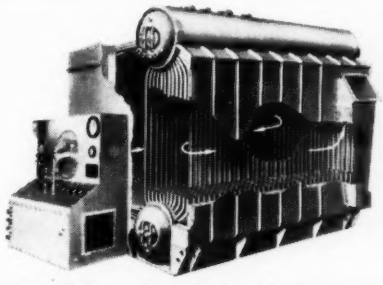
The boilers illustrated here cover the broad capacity range from 4,000 to 600,000 lb of steam per hr. They are all especially designed for gas and/or oil firing. The two units illustrated at right (Types VP and VU-55) are standardized and each is available in several sizes. The capacity range covered by these two units is from 4,000 to 120,000 lb per hr. The two units below are custom designed for various capacity, pressure and temperature requirements up to 600,000 lb per hr, 1400 psi and 950 F. All these units are pressure fired and do not require induced draft fans.

Collectively, they offer an exceptional diversity of choice. A brief consideration of the features of each type will help you "pinpoint" the design characteristics best suited to your particular needs.

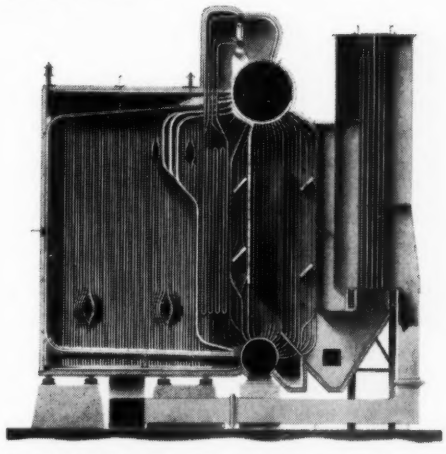
Of course there are other C-E two drum Vertical-Unit Boilers available for pressures up to 1400 psi and temperatures up to 960 F. Shown here are but four popular members of the C-E family of Vertical-Unit Boilers—a family which has achieved a wide measure of acceptance using all types of fuel.

Please feel free to call on us for further detailed information. Catalogs are available upon request.

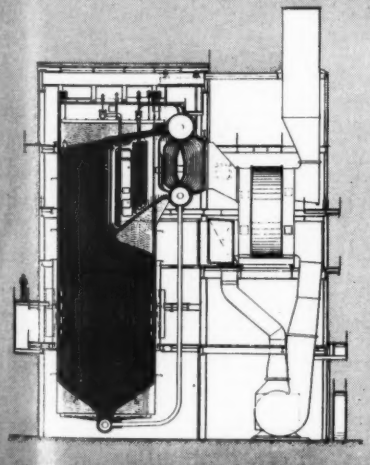
B-922-A



C-E Package Boiler — Type VP Completely shop assembled . . . available in fourteen sizes from 4,000 to 40,000 lb capacity . . . pressures to 500 psi. Available with integral console control panel, this unit contains more water-cooled area per cubic foot of furnace volume than any other boiler of its size and type. It can be equipped with any of several approved burners.

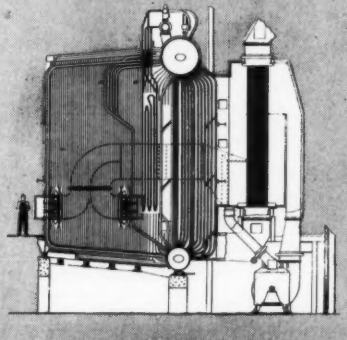


C-E Vertical Unit Boiler — Type VU-55 Available in six sizes . . . capacities from 50,000 to 120,000 lb steam per hour . . . designed for two pressure ranges, 250 psi and 500 psi, and total steam temperatures up to 750 F. This double cased, gas-tight unit is equipped with tangential burners. A large (60-inch) steam drum assures generous water capacity and steam reservoir space. Tangent tube waterwalls offer complete furnace protection, minimizing maintenance.



C-E Vertical Unit Boiler — Type V2

This unit is available for capacities from 200,000 to 600,000 lb per hr. It can be designed for pressures up to 1400 psi and for temperatures to 950 F. Tilting tangential burners, providing superheat control, are standard equipment although horizontal burners are available, if desired. A double, gas-tight casing assures lifetime tightness and minimum heat loss. Heat recovery equipment can be furnished as desired.



C-E Vertical Unit Boiler — Type VU-50B

This unit is available for capacities from 50,000 to 400,000 lb per hr—pressures to 1400 psi and temperatures to 950 F. This bottom-supported design uses tilting tangential burners providing effective superheat control. Horizontal burners can be furnished if desired. Heat recovery equipment as required. This unit makes available to industrial installations a standard of performance comparable to utility practice.

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STEAM GENERATING UNITS · NUCLEAR REACTORS · PAPER MILL EQUIPMENT · PULVERIZERS · FLASH DRYING SYSTEMS · PRESSURE VESSELS · HOME HEATING AND COOLING UNITS · DOMESTIC WATER HEATERS · SOIL PIPE

d'Audiffret, president of Ranney, and he explained why it was that they were so anxious in having us see the Granite City job.

He said that on this project they were working with three independent consulting engineers and a special consultant on fluid flow. Sheppard, Morgan & Schwaab, civil engineers, of Alton, Ill., had handled the surveying and the laying out of the pipeline. Sverdrup & Parcel, Inc., of St. Louis, had designed the reservoir and electrical controls. Alden E. Stilson and Associates, Ltd., of Columbus, Ohio, had designed the facilities at the canal. Also, Hydrotechnic, of New York, had advised on problems in connection with water hammer and fluid flow. So, there had been a great deal of independent engineering advice in connection with the job. He had wanted us to know about this relationship, and he wanted it known that Ranney had not only encouraged the use of independent consulting engineers on the design work but had been responsible for their being engaged.

No "Free Engineering"

Mr. d'Audiffret is anxious for consulting engineers to know that his firm has seen the light. They do not intend to ever do any "free engineering" for any customer. Instead, they will ask the customer to hire a consulting engineer for all design work, and if the customer is not inclined to follow their suggestion, Ranney will, themselves, engage a consultant and pay the fee. They would prefer that the customer engage the consultant, for then he acts directly as an agent of the owner, but if that is not agreeable to the owner, then Ranney will engage a consultant and impress upon him that while the fee is coming from them, the consultant's job is to serve the best interest of the customer.

All Ranney wants to do, according to Mr. d'Audiffret, is the contracting. The engineering they want done by an independent consultant. When it comes to deciding what one of their specialized horizontal wells will do in a particular location, Ranney thinks that they should do their own engineering, but they do like to have their work checked by independent water supply engineers or hydrologists. And on any job involving pipelines, pumping stations, reservoirs, or intakes, they want independent consultants to supply the designs and layouts, and to supervise construction.

"That is the way it should be," d'Audiffret said. "It took us a long time to learn, but we know now. Up until several years ago, we worked on the premise that most consulting engineers were prejudiced or hostile, or both. It was a bad policy, and it has been changed — reversed! A lot of consultants remember us as we once were, and it is no wonder that they forget us when they are called upon to write specifications for their clients. We were in the wrong, and we admit it.

"Your publication and many of the consulting engineer associations have been fighting against this 'free engineering' business, and I want you to know you have a convert. From now on we stick to contracting. It is better for us, and it will be better for the consulting engineer and his client — our customer.

"We know a lot about well drilling and water supply. We have been in the business a long time. The knowledge we have is available to any consulting engineer who wants it, and he can be sure that we are not giving it away 'free' to one of his clients."

We left the luncheon with Mr. d'Audiffret feeling that something important had been accomplished. Here was a serious offender who now saw the advantage of working with consulting engineers rather than against them. All that is needed now are a few thousand more converts like Ranney. Every engineer in private practice should write them a note congratulating them on their conversion. May they continue to live in righteousness.

In the afternoon we stopped by Sverdrup & Parcel and had a pleasant hour with General Sverdrup. He had just returned from a military mission to Japan. He showed us excellent photographs of the trip.

Missouri Association Annual Meeting

In the evening we attended the Annual Meeting of the Missouri Association. L. K. Crawford, president of the newly formed Illinois Association of Consulting Engineers was present. He says they are now well organized and are making progress in their efforts to combine with the older but smaller Chicago Association. The Illinois Association plans to apply for membership in the Council as soon as application forms are available. They hope to be admitted at the next Council Directors meeting, in February.

President Joe Williamson, Jr. called for a report of the nominating committee, and the nominees were then elected by acclamation. The new president is Hueston Smith, Jack Harvie is vice president, Marshall Loughin is secretary, and Wilbert Rath is treasurer. Williamson and Louis Hamig were elected to the Board of Directors for three-year terms, and William Becker is the national director on the Council with Williamson as his alternate.

It came out during the committee reports that the final draft of the Electrical Code has now been completed and is ready for printing. The Association has received more than a hundred requests for the Code, from every state and several foreign countries.

At the close of the program, Joe Williamson, retiring president, reviewed the accomplishments of the year and pointed to the great amount of work yet to be done by the incoming administration.

This association, young as it is (this was the First Annual Meeting) has done much good locally, and it can take credit for much of the early work connected with the founding of the Council.

We sat up far, far too late talking with Williamson, Crawford, and Joyce after the meeting. ▲▲

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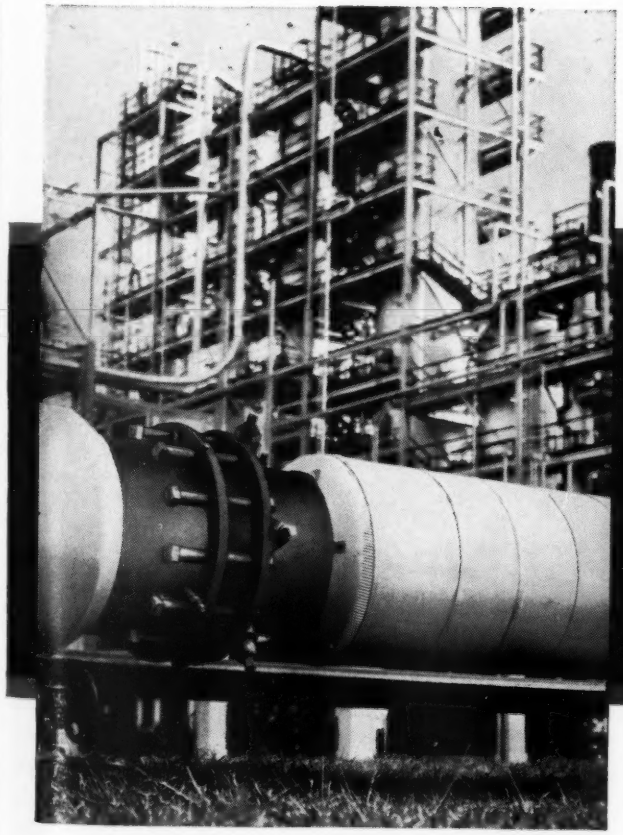
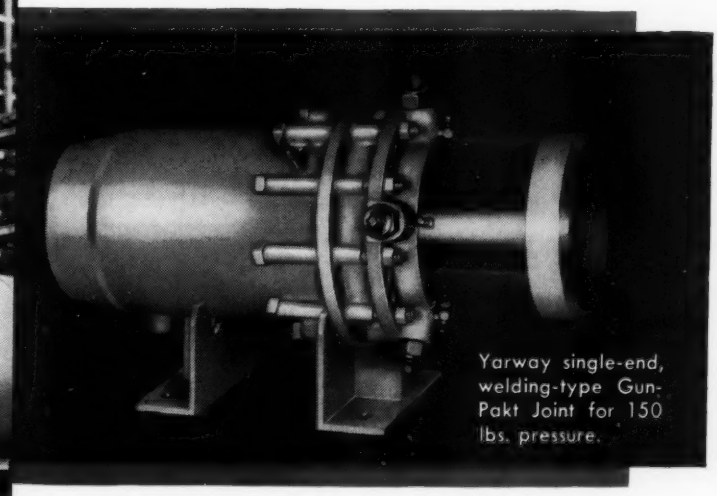
FEWER JOINTS NEEDED. With Gun-Pakt Joints you need fewer joints per length of pipe line, with traverses up to 12" single and 24" double.

LONG SERVICE—NO METAL FATIGUE. Gun-Pakt Joints give long, trouble-free service life—no fatigue failures.

LOW MAINTENANCE. Maintenance records show the costs for servicing Gun-Pakt Joints are very low. One utility reports only 65 cents per year per joint—another reports less than half that.



One of 37 Yarway Gun-Pakt Expansion Joints installed at giant oil refinery on Gulf Coast. Gun-Pakt Joints at this refinery range in size from 1½" to 14".



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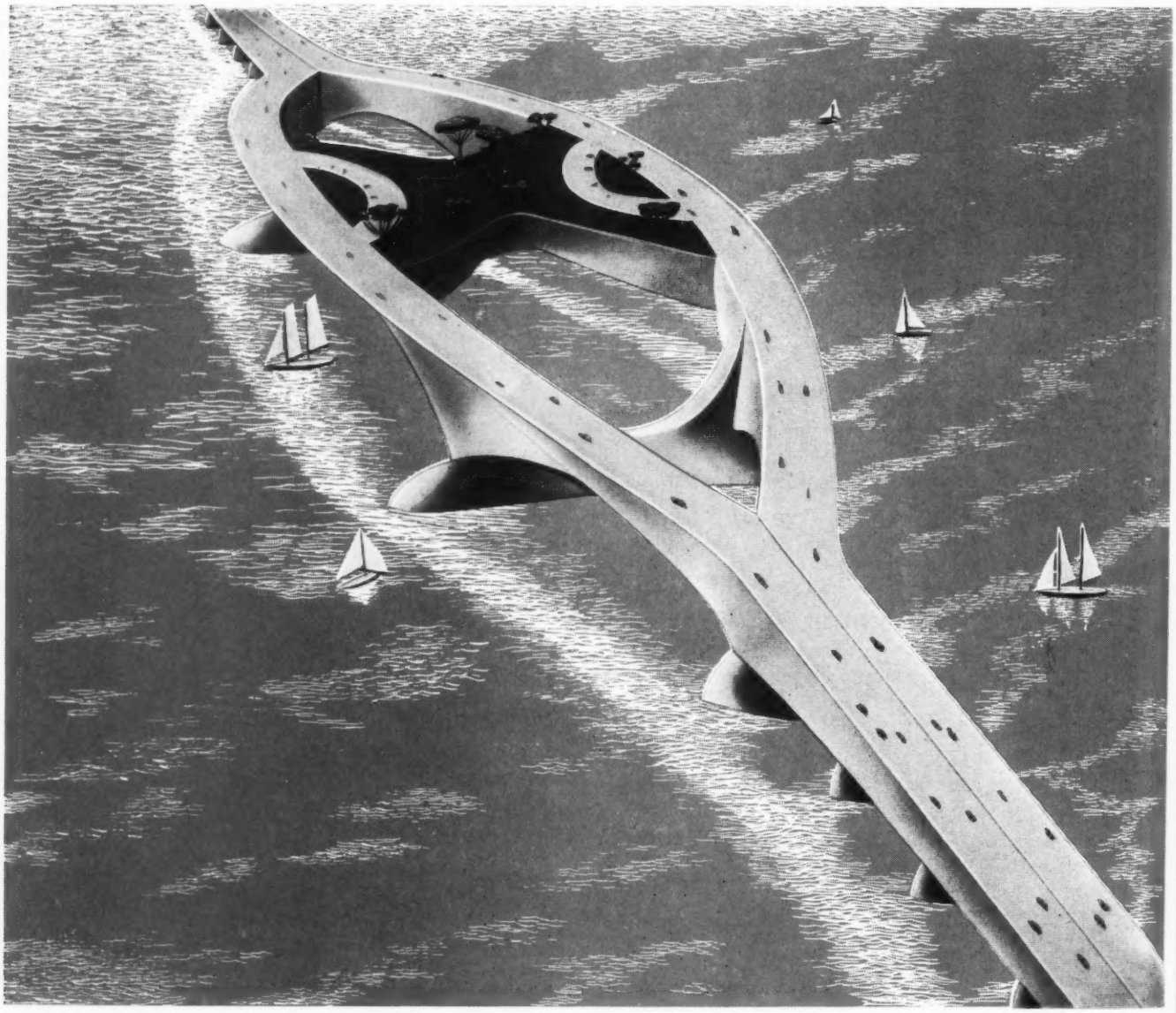


PROPOSED POLIVKA-WRIGHT BRIDGE OF PRECAST ARCHES, SHELLS, AND PIERS WOULD CROSS SAN FRANCISCO BAY.

Precast Concrete Comes of Age

PRECAST CONCRETE has been used for parts of structures and structural members for more than a half a century, but the new, revolutionary developments of reinforced and prestressed concrete during the last decade have enormously widened the applications for precast concrete design. Every engineer should become more familiar with basic principles and recent progress in this field.

It is frequently stated that all the basic principles of precast concrete structures were originated and developed in European countries and that engineers in the United States adopted these methods only about two decades ago. This is not quite correct. It is known, for instance, that in 1886, P. H. Jackson, a San Francisco engineer, obtained patents relating to the principles of prestressed concrete members, which in majority are precast today. In fact, many concrete structures in America during the first quarter of this century were precast.

Early U. S. Designs

The design and construction methods of American engineers during the early years of this century were of high standard and resemble very much to those used today. The "Unit-Bilt" method of precast concrete construction has been used for many train sheds, carbarns, and warehouses. This method

was controlled at that time through a number of patents held by the Unit Construction Co., of St. Louis. Their western representatives, the Van Saint-Houghton Co., of Denver and San Francisco, have been very successful.

The economy of "Unit-Bilt" was thoroughly checked on the construction of the carbarn and repairshop of the Central Pennsylvania Traction Co., of Harrisburg, Pa., designed by Mason D. Pratt, consulting engineer. This building was a duplicate of an identical structure which was poured in place. Exact comparison of costs showed a 15 percent saving in favor of precast concrete.[1] The building, 360-ft long and 75-ft wide, with 16-ft 6-in. clearance, had two bays, each spanning 37 feet. The 3½-in. thick roof slab rested on 38-ft long girders, 1-ft wide and 2 to 3-ft deep, on 10-ft centers, and supported by 16-in. square columns.

The snowshed for the Southern Pacific, built in 1914, was an umbrella type, spreading 18 feet, the outer edge of the cantilevered wing being 16-ft 4-in. above the top of rail. The units were manufactured in casting yards, transported to the site on flatcars, and erected by a locomotive crane. The train sheds in San Francisco and Los Angeles were designed by J. Q. Barlow, and those at the Denver Union Depot, built in 1916, were jobs of H. W. Cowan and J. G. Gwyn, assisted by S. Houghton, engineer in charge.

In 1915, a 92-ft wide, 15-stall, roundhouse in precast concrete was built at Riverbank, Calif., for the Atchison, Topeka & Santa Fe Railway. This was followed by a 25-stall structure of the same type at Redondo Junction, Calif.

The methods of assembling and bonding individual precast members was very similar to those used today. The protruding bars of two jointed girders and the corresponding protruding bars of the column were securely fastened by cable clips, thus increasing the bond between steel and concrete by mechanical means. Today, welding generally is used. The bond between the roof slabs was provided by grouting the joints and 1 x 3-in. keys in the side of the framing struts. The struts on the top of the girders were bonded by grouting and protruding bars fastened by clips.

FLOOR OF BUILDING IN PARIS USES PRECAST GLASS-CONCRETE PANELS.

The roundhouses of the San Pedro, Los Angeles & Salt Lake Railroad at Lunndyl, Utah, were similar to those at Riverbank and Redondo Junction. However, the erection was performed during extremely unfavorable winter weather. All structural units were precast before the cold weather set in. To quote the consulting engineer, Shirley Houghton. "This procedure resulted in the building being completed

J. J. POLIVKA, D.Eng.Sc.
Consulting Engineer
Lecturer, Stanford University

Dr. Jaro Joe Polivka is now a consulting engineer in Berkeley, Calif. He received his doctors degree in technical sciences at the Prague Technical University, where he studied under Professor Joseph Melan, one of the world's leading bridge experts. He did further post-graduate work at the Federal Institute of Technology in Zurich, and in Paris. As a consulting engineer, he designed and supervised construction of many bridges and concrete structures in Europe. During the last war he did important research work for national defense in the Engineering Materials Laboratory at the University of California and did special work for a number of defense industries. In addition to his current consulting practice, he is lecturer on contemporary structures at Stanford University. Dr. Polivka is a member of ASCE, ASME, ACI, and a number of other technical organizations in this country and abroad.

PRECAST GLASS-CONCRETE SLABS, A SPECIALTY OF THE AUTHOR, WERE USED IN DUTCH GRAIN EXCHANGE ROOF.

and turned over to the railway company several months before it would have been possible to do so with any other form of construction than the 'Unit method'."

Kaweah River Conduit

Various types of walls were constructed in precast concrete at that time, and some of them are worthy of mention, since similar principles still are being used today. In 1913, S. L. Stovall, Stockton, Calif., built a 5-mile conduit on the Kaweah River, in Tulare County, Calif., of which a large part (18,000 feet) had side slabs of precast, reinforced concrete. The conduit was 9-ft wide and 4-ft deep and was assembled in L-shaped, 12-ft long, slab units, 3-in. thick at top and 5-in. thick on bottom.

Wire fabric reinforcement was left projecting from the slabs and later was carefully tied to the reinforcement in the bottom of the conduit so that the vertical slabs acted as cantilevers. All slabs were set 2-in. apart at the ends. Sheet iron forms for pilasters then were hung over the joints on the outside, and after proper reinforcement was installed, the concrete was poured, filling simultaneously the 2-in. joints between the slabs and embedding the protruding wire mesh. About 3000 feet of the conduit was resting on precast concrete bents.

The casting yard, which covered nearly an acre, was near the head works, where suitable aggregates were available. The forms were removed after five days, when the slabs were edged up and cured for two weeks by covering with damp burlap. The slabs were distributed along the conduit line on cars over a narrow-gage railroad, which proved to be cheaper than handling an equal quantity of loose concrete material. The advantages of precast concrete in this application are summarized by the engineer and builder as follows.[2]

"The necessity at the present time [1918] for increased efficiency and conservation in the use of materials calls for radically new methods in the construction of flumes. There are serious objections to the use of timber and steel. Their installation and upkeep are expensive. They make a serious fire risk. The life of timber is short, and if the water carries much sand, a steel flume is soon cut out at the bottom. Concrete, as a material of construction, meets all requirements most successfully.

"Concrete flumes usually have been poured in place. Handled in that way, there are two serious objections to concrete as a material for flume construction. A great deal of lumber is required for forms—nearly as much as would be necessary for building a timber flume.

"The deep narrow walls into which the concrete has to be poured make necessary the use of more material than the required strength demands, and the placing of this material in the restricted working space available is slow and expensive. Both of these objections are overcome in the precast concrete flume."

The Troy Locks

Another type of precast concrete wall was used for the Troy Lock on the Hudson River, in 1916, where a novel construction method proved to be highly economical. The work, completed by the local office of the U. S. Engineers, was described in the

magazine *Professional Memoirs,* 1917, by John J. McCabe, who was in charge of the work. The lock guide-wall was 235-ft long and consisted of a continuous upper wall, 11-ft high, extending 1½-ft down below the water level and resting on a series of piers, built of precast concrete cribs with very thin walls, which later were filled with concrete.

Precast concrete slabs for sea walls was another type of hydraulic structure which was initiated at about that time by Henry Schlueter, of Los Angeles, who also was granted patents for some new ideas in this field. Naturally, all these and other patents are no longer valid. The sea walls at Long Beach, Calif., consisted of interlocking precast concrete slabs, 42-in. wide, 17-ft 7½-in. long and 5-in. thick, with edge struts, 8 x 12 inches, placed horizontally, at an angle of 53 degrees. For placing these precast wall panels along the 1706-ft beach, a special driving rig with steam hammer, water jet, and hoisting engine was used. The vertical parapet walls, extending 7-ft above the top of the inclined slabs, also precast, were slightly curved for better protection from the waves. The design was prepared jointly by the city engineer of Long Beach and Henry Schlueter.

Rock River Snow Sheds

One of the most spectacular applications of precast concrete at that early stage was the snowsheds at Rock River, Wyo. Design and construction were in every respect excellent, and even today there are not very many structures designed and built to be compared with them.

During the winter of 1916-17 the Union Pacific Railroad Co. experienced considerable difficulty in maintaining traffic at several points on the Wyoming Division, on account of drifting snow. Both mainline tracks were blocked completely several times. Emergency wood frame sheds with corrugated iron covering were built during the winter to maintain traffic. Because of the great fire hazard and high maintenance cost of this type of shed, the company decided to build permanent structures in precast concrete. The structures consisted of rigid frames spaced 15-ft apart, spanning 35 feet for double-track sheds and 50 feet for three-track sheds. Other forms of frames were used according to the variation of track arrangement.

The A-frame type of side columns were used on account of the exceedingly violent winds prevalent in Wyoming. Openings in the roof directly over the tracks, and in the walls near the eaves, permit prompt escape of smoke. Asbestos boards were fastened to the underside of the frame girders directly over the stack. Typical roof slabs, 2-in. thick, were cast in panels 4-ft 4-in. x 14-ft 11½-in., strengthened by edge struts 8-in. deep and similar struts at the third-points of the length. The ends of the wall slabs fit in grooves in the A-frames; the roof slabs rest directly on and have shoulders to bear against the sides of the frame girders. The bottom of the A-frame fits in pockets in the pile cap with a ¾-in. clearance all around to permit exact adjustment. Four, ¾-in. square rods project from the top of the A-frame and enter corresponding 2-in. pipes embedded in the roof girders. The bottom of the A-frame is grouted into the pile caps, and the rods from the A-frame through the roof girder are grouted in with a thin cement grout. Sides and roof of the sheds are designed for 50-psf live load.

Construction Methods

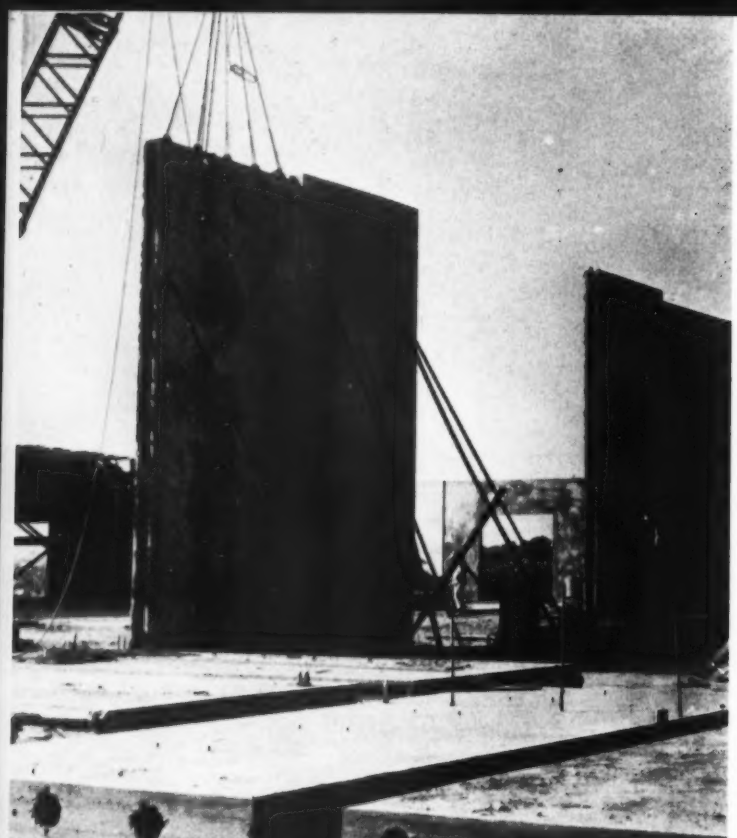
At Rock River, 4470 lineal feet of three-track shed was built. Double-track sheds were erected at Wilcox (1500-ft long on a 1°6′ curve), at Medicine Bow (1800-ft long over tangent track), and at Sulphur Lake Cut (500-ft long on a 4° curve).

The mixing yard for all jobs was at Rock River. The plant consisted of one central tower, 144-ft high, and two distributing towers, 75-ft high, with railroad serving tracks, elevated car runways, and form platforms between. From the mixers the concrete flowed by gravity to two buckets—one for each mixer—at the foot of the main tower. After being hoisted to the receiving hopper it passed through pipes to hoppers in the distributing towers, and thence flowed through jointed troughs to small cars on the various elevated runways between the casting platforms. It discharged from the cars to the forms by movable inclined troughs, with openings in the bottom, which spanned the forms.

After the concrete was poured it was constantly sprinkled for three days. The precast structural members were removed from the forms after five days, loaded on cars by cranes, transferred to the curing yard where they were cautiously cured at least two weeks.

The forms were very strongly built, and their sides were hinged and held in place by wedges so

TIOGA BUILDING, IN BERKELEY, IS GOOD EXAMPLE OF NEWLY DEVELOPED LIFT SLAB METHOD.



ON TILT-UP CONSTRUCTION, SLABS ARE CAST ON GROUND AND THEN TILTED TO VERTICAL POSITION.

that the members could be removed without damage to the forms, which was very important for the multiple use.

The members were erected by locomotive cranes running on temporary construction tracks paralleling the main-line tracks, as traffic was so heavy that neither main-line track could be spared for erection purposes.

Work was carried out under the direction of W. R. Armstrong, maintenance engineer of the Union Pacific Railroad. W. L. Brayton, consulting bridge engineer, designed the structures, and L. W. Althof was engineer in charge of construction.

Period of Stagnation

These few examples are described in detail for the purpose of showing that the construction methods with precast concrete have not changed very much during the past 40 years and that American engineers and builders were not far behind Europeans in these techniques. Certain stagnation of interest, lack of concern for economy, and the enormous growth of the American steel industry after the first World War was responsible for the decline in concrete precast construction during the period 1925-1945. Revival of interest began again after the second World War.

There also was considerable American indifference to engineering achievements in European countries, an attitude which completely changed with the new atomic age. One of the leading American experts in precast concrete, Arsham Amerikian, who designed floating dry docks and floating caissons in reinforced concrete for the Navy's Bureau of Yards and Docks, believes that "some of the apparent hesitancy on the part of engineers may be due to a natural reaction against adaption of a new system and that another adverse factor has been the lack of sufficient information regarding the method and its application . . . [Precast] thin-shell technique has received no promotional publicity to advance its utilization. As yet [1953], only a few engineers and architects have made even a partial use of such framing arrangements in their work . . . "[3]

Polivka-Wright Bridge

From the viewpoint of this criticism it can very well be understood why the State Legislature Committee, in California, in the report on six proposals for the second Transbay Crossing in San Francisco[4] commented on the Polivka-Wright Plan, the so-called Butterfly-Wing Bridge, which would save approximately $100 million of public money, as follows: "One of the most original proposals submitted to the Committee was the reinforced concrete bridge designed by the well known architect Frank Lloyd Wright and engineered by Dr. J. J. Polivka, of the University of California . . . While this type of bridge is relatively unknown in the United States, it is found to be widely used in Europe. It has a low maintenance cost and is reported by its designer to embody all the safety factors found in steel construction . . ."

This structure is a combination of precast concrete arches and shells supported by hollow precast concrete piers to be poured on the shore and then buoyant floated and towed to the site where they would be sunk in dredged pits. After accurate placement of the piers, the sand surrounding their bot-

HOLES ARE CAST IN BOTTOM OF SLAB FOR ANCHORED REINFORCING BARS. THEN HOLES ARE GROUTED.

toms would be chemically solidified from the hollow interior[5] in places where bearing soil is too deep below the mud.

I had used the methods of precast concrete in 1915, in Switzerland, and later in several other European countries.[6] Of special interest is a structure I designed and supervised at the Paris International Exposition of Arts and Techniques, in 1937, in which thin-shell precast floors were utilized.[7] In this building slab panels 1.05-in. thick were strengthened by cross ribs, 1-in. wide at the bottom and tapered, with total depth of 2½ inches. Special vibration methods plus setting admixtures allowed the steel forms to be removed immediately. The materials and precast members were tested in the laboratory of Paris Ecole des Ponts et Chaussees. The average compressive strength of concrete at 28 days was found to be 7800 psi, and the bearing capacity of slabs was 340 psf. Cost of the complete floor units in place, in 1937, was $0.20 per square foot, which was extremely low even considering the low cost of wages and materials.

For the floor of the terrace along the Seine River, precast panels of glass-concrete were used with large embedded glass lenses. The latter type of structure was a special field of mine and was utilized in a great number of buildings[8] in several European countries, one of the most interesting and original being the International Grain Exchange Building, in Rotterdam, Holland, built in 1938.[9] Here the precast glass-concrete slabs of typical size, 4 x 6½ feet, were only 1¼-in. thick with edge ribs 2½-in. deep. Corner panels were round. Automatic vibration and a special concrete mixture were responsible for extremely high strength of concrete (11,000 psi at 28 days) and for the bearing capacity of the precast panels, five times as high as designed (240 psf).

Spectacular Structures

The tremendous, and still growing, use of precast concrete in various fields of modern construction during the past decade has resulted in many spectacular structures with new improvements and still greater economy, especially if prestressed concrete is used.

The so-called "tilt-up" structures have become popular. Wall panels are precast on concrete floors of the building in such a way that they can be tilted up by a crane into their final position. However, most of the precast members and structural elements of today are fabricated in locations distant from their final installation, very often in special plants or warehouses. The description "tilt-up" should not be applied to these. One of the main advantages of prefabrication in warehouses is better curing of the material under constant temperature and humidity.

Today, precast concrete no longer is limited to joists, beams, long-span girders, columns, and wall, floor, and roof panels. For example, the so-called "lift-slab" method[10] is another highly economical type of precast concrete structure. Hinged and rigid frames, arches, bridges, barrel shells, and domes also are precast and erected with amazing economy. I was able to design commercial and industrial buildings, warehouses, retaining walls, and bridges with savings up to 50 percent compared with concrete structures poured in place. Some of them are illustrated. ▲▲

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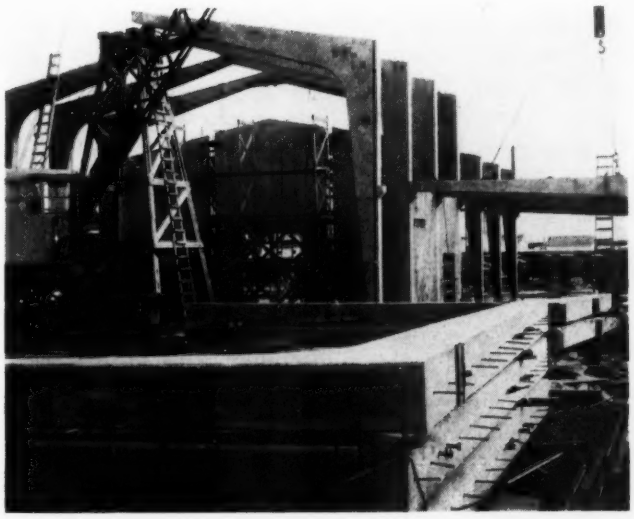
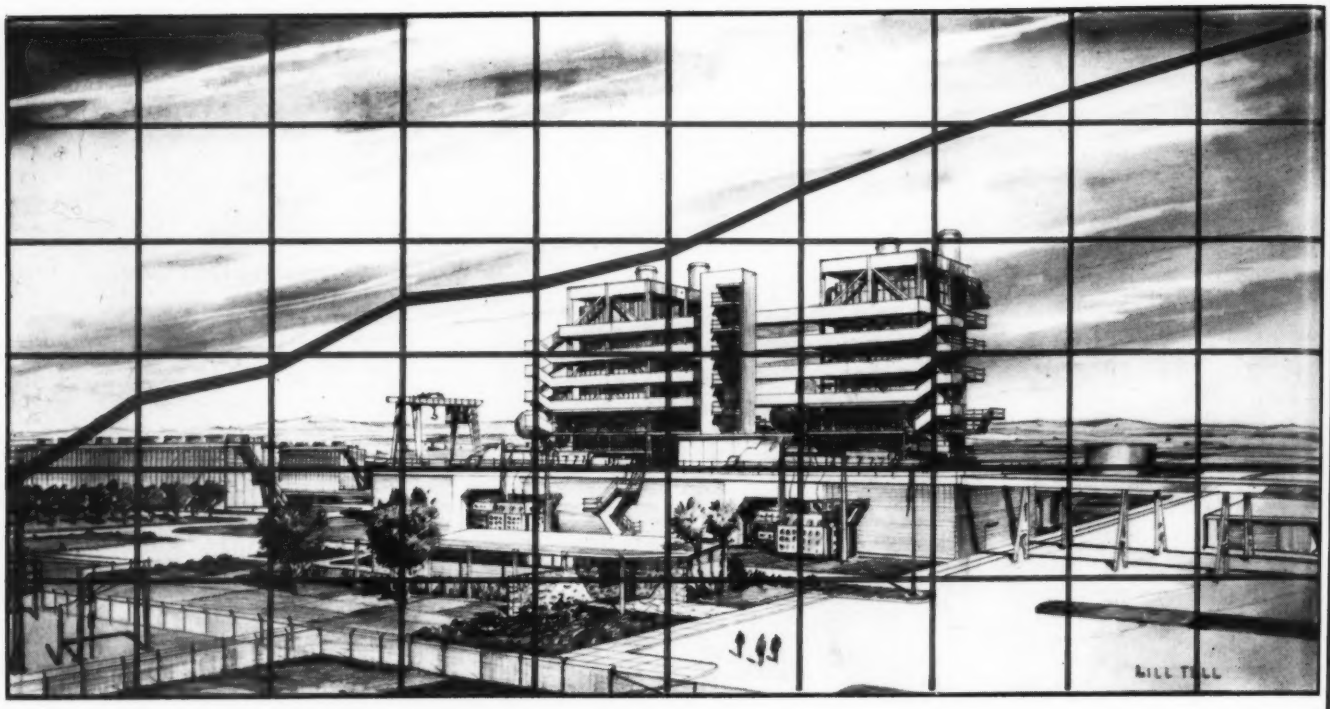


DAIRY BUILDING ENTIRELY OF PRECAST CONCRETE. TWO STRUCTURES ARE CONNECTED BY BRIDGE.



Engineering Construction to go up in '57

E. F. MAC DONALD
Industrial Economist

IF NEEDS WERE THE SAME as effective demand, CE exclusive the construction industry would be so swamped with work, the boom would go on forever. As it is, there are some who see construction activity on an interminably rising trend. And if we want to indulge our fancy and chase from our minds the cyclical aberrations of days gone by, it is difficult to picture a future marred by idle construction crews.

It is not too far from fact to say that the nation is being rebuilt!

Are we not about to rebuild 40,000, possibly 52,000, miles of main highways? Are not an increasing number of cities (over 200 at present) rebuilding extensive areas in accordance with urban renewal plans? Is there not an almost fantastic backlog of public construction projects for the suburban growth that already has occurred? What about school building — grade, high schools, and colleges — is there any doubt that an accelerated nationwide program of school building will soon be under way? And how are so many cities to stay the deadly effects of their hardening arteries if they do not put expressways into the air or under the ground and provide off-street parking facilities for millions of cars?

Another Five Percent

It is certainly not wild-eyed to hold that after eleven consecutive postwar years of increases in outlays for new construction (see Fig. 1), the boom is still in its growth stage. And 1957 is being counted on to extend the years of the boom to an even dozen. According to the "annual reading" given jointly by the United States Departments of Commerce and Labor, outlays for new construction this year will rise to the all-time record amount of $46.4 billion. This would be about 5-percent above the 1956 total of over $44 billion, thus maintaining the rate of expansion in 1956.

As are all soundly conceived forecasts, the Commerce-Labor estimates of construction activity this year are based on certain assumptions. The government experts assume:

¶ That the general level of economic activity will advance moderately with employment continuing at record levels, and personal income rising to a new high.

¶ That international developments will not significantly affect domestic construction activity.
¶ That construction costs will continue to rise but at a lower rate than in 1956.
¶ That building materials in general will be in adequate supply, with only minor spot shortages likely.
¶ That mortgage funds probably will continue to be relatively scarce, particularly for long-term, low down-payment loans.

The expansion foreseen this year in this authoritative analysis by government economists is pretty much across the board. In fact, the only declines anticipated are in residential building and in the building group of stores, restaurants, and garages.

New Norm?

The volume of work to be put in place in 1957 on private nonfarm residential construction is estimated to slide off about 3 percent from the 1956 total. Anticipated gains in outlays for additions and alterations to existing homes and in construction of motels and other nonhousekeeping residential units will not be sufficient to take up all the slack from the 5-percent decline expected in outlays for new home building. As was true last year, it is believed that the decline in dollar outlays for private housing probably will be less than the drop in housing starts. This will be a consequence of higher building costs and of the increasing weight in the total starts of larger homes of higher quality.

Despite the likelihood that residential building and mortgage credit will be in relatively restricted supply again, the government study looks for about a million new nonfarm dwelling units to be started in 1957. There appears to be considerable agreement among other experts with this figure. Evidently, the assumption is prevalent that the bottom has been reached in the adjustment from the situation that produced 1,310,000 new privately financed homes in 1955. It is felt that until the early Sixties when the influence of anticipated sharp increases in marriages and family formation is felt, new residential starts are likely to hew fairly closely to the one million mark.

This decline in residential construction is, of course, of more direct interest to architects and contractors than to consulting engineers, few of whom are engaged in residential work.

NEW CONSTRUCTION ESTIMATES FOR 1957

	Millions of dollars	Change from 1956
New Construction	46,400	5%
Private		
Residential (excluding farm)	14,700	— 3%
New dwelling units	12,700	— 5%
Nonresidential building	9,725	5%
Industrial	3,200	5%
Commercial	3,300	0
Office buildings & warehouses	1,500	10%
Stores, restaurants, & garages	1,800	— 7%
Religious	875	13%
Educational	550	3%
Hospital & institutional	400	23%
Social & recreational	300	11%
Misc. (Fire stations & hangers)	650	21%
Public utility	5,750	13%
Electric light & power	2,100	11%
Gas pipelines, etc.	1,725	23%
Public		
Nonresidential (largely schools)	4,500	11%
Highway	5,500	8%
Military facilities	1,525	7%
Sewerage facilities	875	23%
Water supply	675	16%
Public service enterprises	475	6%
Conservation & development	800	21%

Source: Joint Estimates of Dep'ts. of Commerce and Labor.

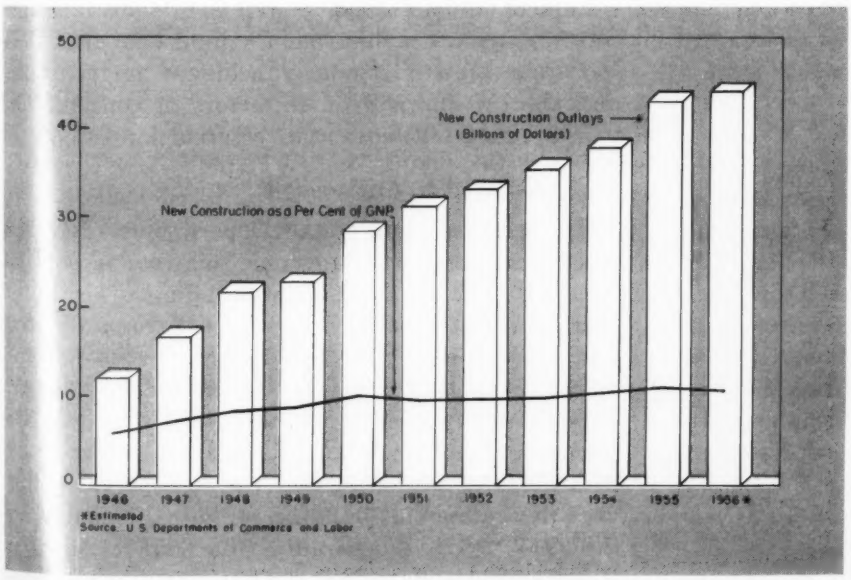
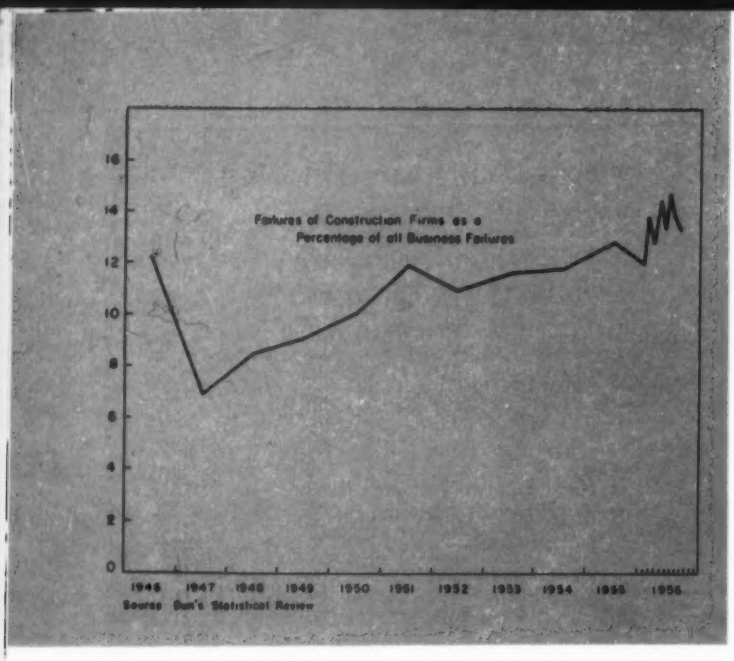


FIG. 1—TWO VIEWS OF THE CONTINUING POSTWAR CONSTRUCTION BOOM.

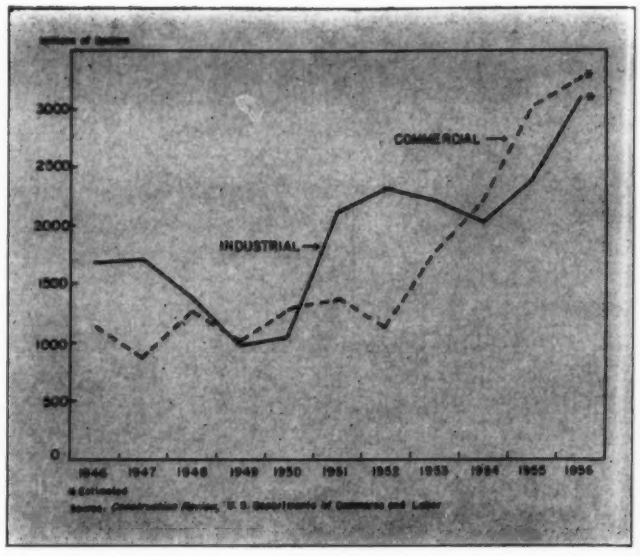
Slowing Down

Engineers are more concerned with industrial and commercial building. At this time last year it was expected that industrial plant construction would record the largest gain in outlays of any major sector of private construction. The only thing wrong with the estimate of 17-percent increase was that it was much too modest. Actually, the gain in investment in new industrial plant last year was around 28 percent.

The upsurge in building of industrial facilities appears far from played out (AT&T will spend $2.5



AN UPWARD TREND . . . "IN THE MIDST OF PLENTY."



POSTWAR RECORD OF NEW PRIVATE CONSTRUCTION.

billion for new construction this year, $300 million more than last year), but it is thought to be slowing down from last year's galloping pace. Nevertheless, the 5-percent increase estimated for 1957 by the government economists is a respectable gain.

Dodge Reports

The F. W. Dodge Corporation estimates for manufacturing building contracts in 1957 show a slight increase in dollar amount but a small reduction of 2 percent in physical volume. A more optimistic prospect for combined plant and equipment outlays this year is shown in a new indicator of future capital outlays worked out by *Newsweek* and the National Industrial Conference Board. This is a quarterly report on manufacturers' capital appropriations which will provide an excellent addition to the analyst's kit of tools. The first report of this survey disclosed capital-appropriations backlogs — spending that has been formally approved but not yet started — amounting to the impressive total of $10.4 billion at mid-1956 for the nation's 1000 largest corporations.

Reliable local and regional estimates of future capital spending are difficult to uncover. One of the few surveys of a major metropolitan area is made by the Federal Reserve Bank of Philadelphia and covers six counties around Philadelphia. This survey indicates a strong upward trend this year in the total expenditures of manufacturers for plant and equipment — 13-percent greater than in 1956. However, it notes that it is the large firms that are expanding, since 60 percent of the companies planning changes in their capital budgets are expecting to make reductions.

Too Fast?

Occasional reports are turning up of revisions — on the side of reductions — of capital expansion plans. The reason generally cited: fear of over-expanding capacity. It is likely that some companies this year are going to step back and take a sober look at their capital spending plans, even plans long regarded as firm.

Right now, however, cutbacks of capital expansion plans still are conspicuous exceptions to the rule. Consequently, a few analysts are beginning to ask, "Is industry building too fast?" To justify the inquiry, they point to the very large increases in capacity currently being realized in certain industries in comparison to anticipated sales gains. Perhaps the much lower increase in outlays for industrial construction estimated for this year, as compared with last year (5 percent v. 28 percent), indicates that industry is keeping an eye on this.

It is likely that considerations of this nature, rather than lack of funds or the relatively high cost of borrowing, will be the dominating influence in the volume of actual outlays as well as in plans laid and contracts awarded this year for industrial facilities. Moderate growth regularly achieved is far more desirable in this and other sectors of construction than are intermittent surges of great intensity.

Commercial Building a Standoff

The joint estimate of the Departments of Labor and Commerce is for no change this year in outlays for total private commercial building. This is in sharp contrast to a year ago when it was estimated that such construction would show a 14-percent gain (the actual gain was around 8.4 percent). There is fairly wide agreement with this estimate although a number of analysts figure that there may be a little further expansion (up to 5 percent) this year in commercial building outlays. Estimates by the F. W. Dodge Corporation jibe with this in that it is expected that there will be a 4-percent drop in the physical volume of commercial contracts

awarded but a slight increase in the dollar volume.

The gist of this rationalization is that further expansion (10 percent) may be expected for the commercial sub-group, office buildings, and warehouses. Demand for additional office quarters is still strong, as indicated by low office-building vacancy rates reported about the nation (plans have been announced for construction of a 60-story, $60 million office building in New York City). However, it is expected that the gain in dollar outlays for such new construction will be offset by a decline of like amount in spending for the other commercial building subgroup of stores, restaurants, and garages. Here an anticipated reduction of 7 percent, based on declining contract awards, indicates the possibility that the mushrooming growth of shopping centers is in a tapering-off stage. As 1956 drew to a close, the developing softness in the store-restaurant sector was being scrutinized carefully as a possible forerunner of weaknesses in other forms of commercial building in the months ahead.

Other Groups Strong

However, most of the other groups of private nonresidential building appeared strong at the outset of this year. Although construction of new religious and educational facilities reached all-time record heights in 1956, it is expected that outlays for the churches will run 13-percent higher this year and that 3-percent more will be spent for schools. Dodge estimates that contract awards for religious buildings should increase 10 percent on the basis of physical volume. This same authority looks for a 5-percent increase this year in the physical volume of contracts awarded for private and public educational and science buildings.

Following a decline in 1956, outlays for hospitals and institutional building are scheduled for a healthy increase of 23 percent. Social and recreational construction will likely entail about an 11-percent increase, maintaining the rate of expansion recorded for such construction activity in 1956. Indicative of the broad front on which advances in nonresidential building are anticipated this year is the 21-percent increase estimated for the miscellaneous category — fire stations, airplane hangars, private garages, for example.

The Power Behind Growth

Much of the gain anticipated in private construction probably will stem from increased construction put in place by public utilities, a field in which consulting engineers are much involved. Announced capital programs add up to an unprecedented volume of spending by utilities that may exceed last year's construction bill by 13 percent. The most significant dollar increases in this group are expected to be in new construction of electric power facilities and of pipelines and other natural gas facilities. Percentage increases in these two categories are estimated at 11 percent and 23 percent for 1957.

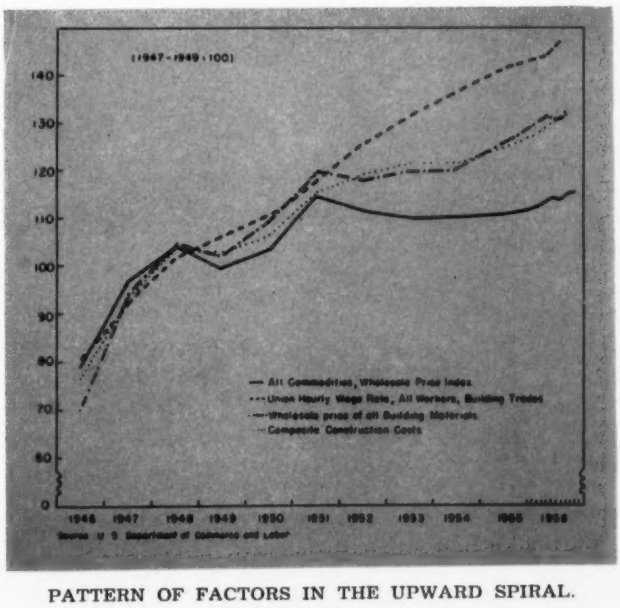
"Prodigious Program" of Public Works

Government estimates place public construction outlays 12-percent higher than last year, with the possibility that physical volume (expenditures adjusted for price changes) also may rise slightly to the record level reached in 1955. In line with these expectations is the estimate by Dodge that contracts awarded in 1957 for construction of public projects will exceed the total for 1956 by 10 percent.

Mr. George Wanders, editor of *The Bond Buyer*, after referring to postponements of municipal bond issues during August, said, "More important by far, over the long run, is the fact that an unbelievably large aggregate of public capital construction is in the works . . These United States are only at the beginning of a prodigious program of reconstruction and expansion of roads and bridges, schools, water systems, and hundreds of other major facilities."

It is true that he refers to the "long run," but the present is part of the long run. The "long run" is under way now, and the increased outlays estimated for public construction projects this year are a reflection of that fact.

The largest dollar gain among the major categories of public construction is expected in nonresidential building. Here the estimated increase of 11 percent stands in sharp contrast to the year earlier estimate of no-change and to the slight decline that actually occurred last year. Accounting for the major share of this increase is the gain anticipated in construction of educational facilities. In this connection it might be worth recalling, even though it may not affect the 1957 estimate, what President Eisenhower said in his Tacoma speech last October. He promised to press "with all the force at my com-



PATTERN OF FACTORS IN THE UPWARD SPIRAL.

mand" for a 4-year, $4 billion Federal-aid school construction program. By way of camparison, public outlays for school building this year are estimated at $2.9 billion. For New York City alone, a 10-year program has been recommended for building new schools and replacing obsolete schools at a cost of $1,350,000,000.

Highway Construction

When Congress declared it "to be in the national interest to accelerate the construction of the Federal-aid highway system, including the Interstate system . . ." it initiated a program which at its peak may involve outlays for highways and bridges that will be double the current annual expenditures. According to the Chamber of Commerce of the United States, more money will be spent in the next 13 years for highway construction on the Federal-aid system alone than has been spent in the last 26 years on all federal, state, and local streets and highways.

Efforts to get this stupendous program under way as rapidly as possible are reflected in the 8-percent increase in outlays this year for highway construction as estimated by Commerce and Labor.

Every other major category of public construction is estimated to require greater outlays this year than in 1956. Construction of military facilities will be up 7 percent; sewerage disposal up 23 percent; water supply 16-percent higher; public service enterprises 6-percent higher; and outlays for construction of conservation and development projects 21-percent above last year.

Cast against the recent background of boom building activity, the construction picture for 1957 as reviewed here is a satisfactory one. What actually materializes as 1957 writes its history might be considerably different from current expectations. Any significant differences, however, would almost have to be on the down-side.

Aside from the contemplation of the onslaught of a severe depression, it is difficult to take issue with the frequently expressed contention that the construction boom is just beginning. It is hoped, however, that what is meant in that connection is sustainable, well-founded growth and not a boom of the sky-rocket type that always ends in an uncontrollable downward plunge.

The facts, however, are that even the most pessimistic analyst would have to admit that the future was never brighter for the consulting engineer. In every construction field except residential the estimates are strongly upward. It is hard to see how an engineer in private practice, whether he is civil, structural, mechanical, or electrical, could expect anything but a healthy increase in the demand for his services in the year ahead. Whether he serves private or public clients, there will be more work in 1957 than he has seen before. ▲▲

TABLE 1 — ANALYSES OF TYPICAL CORROSIVE WATER SUPPLIES
All values except pH in parts per million

City	State	pH	Total Hardness	Total Calcium	Alkalinity	Chloride	Sulfate	Silica	Total Solids
Portland	Me.	6.8	13	10	6	2	7	3	23
Boston	Mass.	6.6	14	10	7	3	6	2	29
Hartford	Conn.	6.4	15	11	7	3	7	4	27
New York	N.Y.	6.9	20	13	10	3	10	3	34
Newark	N.J.	6.8	25	16	11	4	10	3	39
Atlantic City	N.J.	5.0	10	6	4	8	7	10	41
Philadelphia	Pa.	6.6	151	77	31	10	95	8	213
Pittsburgh	Pa.	6.3	75	48	7	20	110	5	220
Charlotte	N.C.	8.6	20	18	19	3	5	11	45
Atlanta	Ga.	7.1	19	15	13	4	5	10	44
Little Rock	Ark.	7.1	18	12	12	3	5	5	31
San Francisco	Calif.	6.4	9	3	6	1	2	4	13
Portland	Ore.	7.0	9	6	12	2	1	7	30
Seattle	Wash.	7.3	18	16	18	1	2	4	37

Water Treatment for Urban Buildings

IT IS THOUGHT by many chemists and engineers, as well as by most laymen, that in urban buildings receiving water from a municipal supply system there are no particular water treatment problems. This is far from true. Even in areas that have high quality soft water supplies, such as New York City, the operators of thousands of office buildings, hotels, department stores, and apartment buildings find it necessary to provide specialized water treatment services to protect piping systems and water-using equipment.

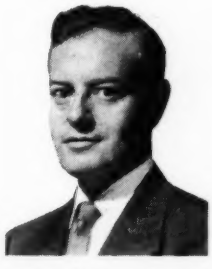
Frequently people ask why a city does not treat the water at the water works to eliminate all trouble-causing potentialities before it enters any building. The answer is that the treatment necessary to avoid one type of water-caused difficulty may result in the development of a different difficulty at another location. For example, the addition of lime to the water for corrosion control will increase the scale-forming potential of the water when used in high pressure boilers and other evaporative equipment. Therefore, most public water utilities limit themselves to providing a water safe for human consumption, providing it in sufficient quantity for all reasonable normal uses and emergencies, and providing an attractive water so that few will be tempted to use private supplies which may be more sparkling in appearance but bacteriologically less safe.

Water treatment to minimize damage to the piping and water-using equipment in a building is a responsibility of the owner, and it frequently is carried out by a specialized service organization.

The introduction of water treatment into large urban buildings involves unusual problems resulting from space limitations, the lack of trained personnel, the intermittent nature of the work, legal restrictions, and, of course, cost considerations.

Domestic Water Treatment

Most public water supplies along the heavily populated Atlantic Seaboard and in several other sections of the country are corrosive. Table 1 shows some



DR. SIDNEY SUSSMAN
Chief Chemist
Water Service
Laboratories, Inc.

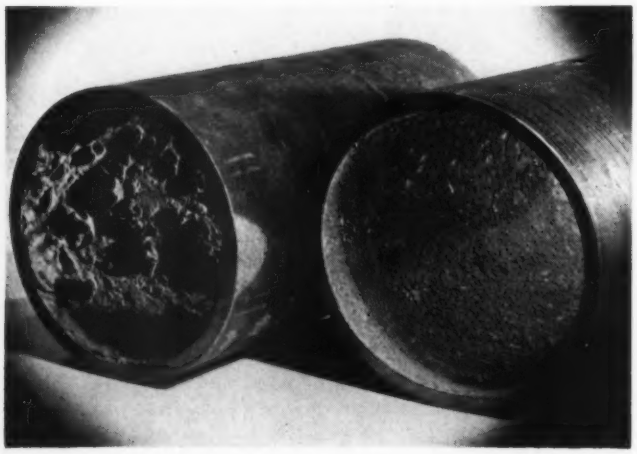
Dr. Sidney Sussman received his B.S. from the Polytechnic Institute of Brooklyn, and his Ph.D. from M.I.T., in 1937. He started as a research chemist for E. I. DuPont de Nemours and Company. He later became chief research chemist for The Permutit Company and chief chemist for Liquid Conditioning Corporation before joining Water Service Laboratories as chief chemist in 1949. Author of more than 20 technical papers and patents, he is a member of the National Association of Corrosion Engineers, American Chemical Society, American Water Works Association, and other technical groups. He is a former pres. of the Metropolitan Water & Wastes Society.

TECHNICIAN OPERATES ELECTRIC COLORIMETER IN MAKING WATER ANALYSIS. THIS COMPARES COLOR OF SAMPLES.

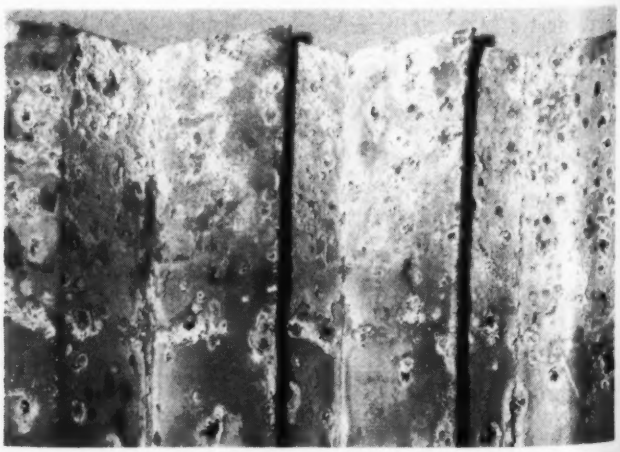
typical water compositions in these areas. With ferrous piping, including galvanized iron and galvanized steel, an unsightly rusty water condition can develop within 6 to 12 months in hot water systems. This is followed by clogging of the pipes so as to seriously restrict water flow and, eventually, by the development of leaks in the pipe wall. These waters also cause serious dezincification of yellow brass[6,7] with resultant weeping or sudden rupture of pipes and other parts when subjected to mechanical stress.

Although a number of methods are available for reducing the corrosivity of water, only two are commonly used for the protection of piping systems in urban buildings. These are neutralizing filters* or the addition of soluble, nontoxic corrosion inhibitors to the water.

*Technically, the neutralizing filter is not a filter at all. The action of these devices results in the net addition of hardness to a water while reducing the free carbon dioxide content. However, the physical construction of the equipment is the same as an ordinary filter, and they are known throughout the water treatment industry as neutralizing filters.



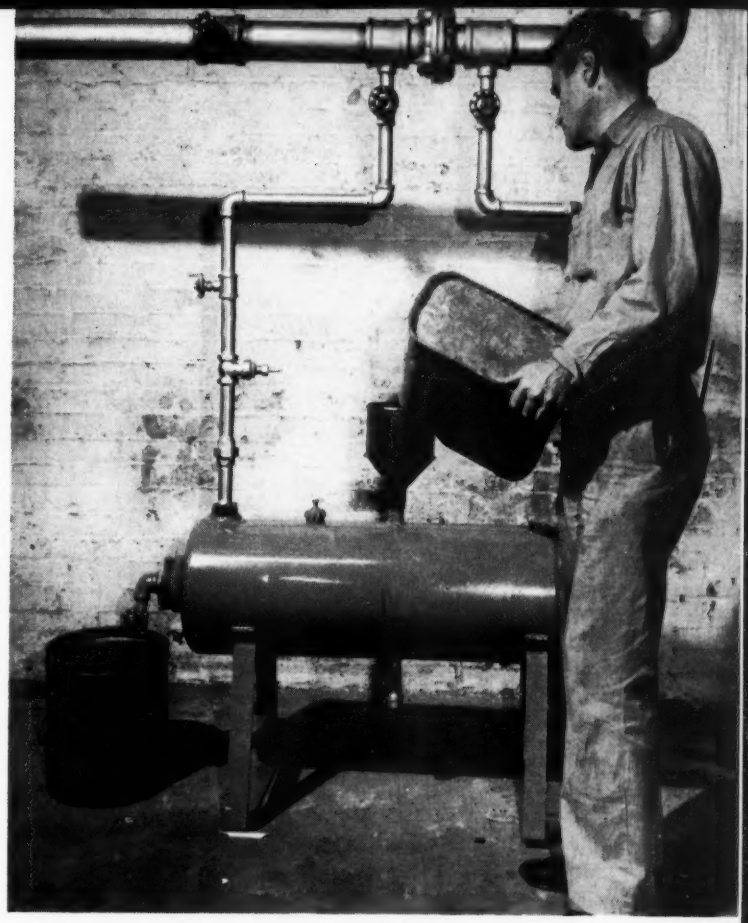
GALVANIZED IRON MAINS SHOW DIFFERENCE BETWEEN ACTION OF TREATED AND UNTREATED WATER.



ALUMINUM CAN BE CORRODED BY UNTREATED WATER. SAMPLE IS FROM AIR WASHER ELIMINATOR PLATES.

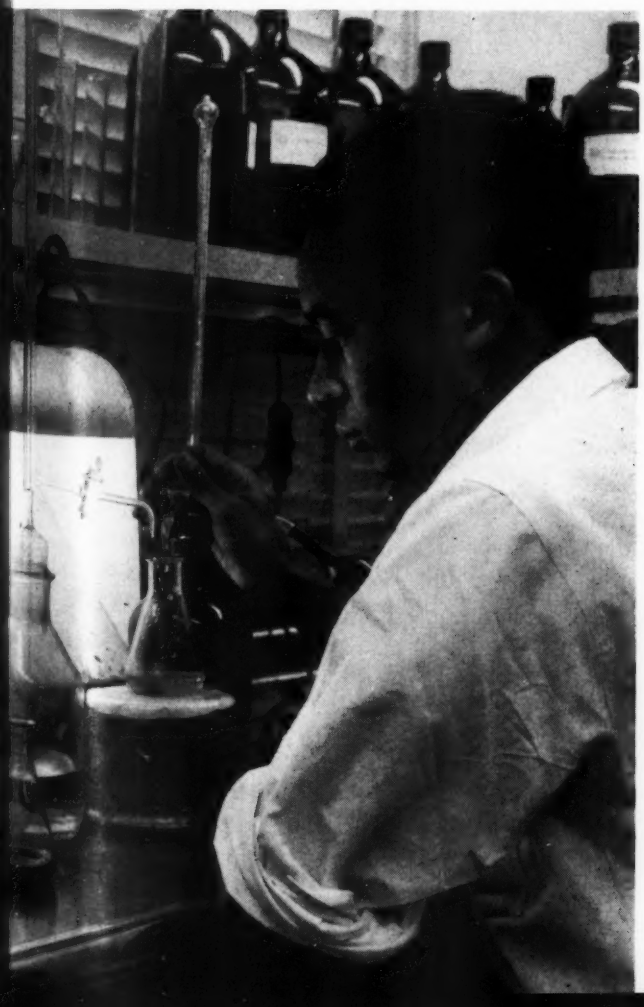
If the corrosivity is due to high carbon dioxide concentration and if an increase in the hardness of the water is not objectionable, neutralizing filters containing granular calcite may be used. These are pressure units outwardly resembling ordinary domestic hot water storage tanks. The water is passed through the filter, and reaction between the dissolved carbon dioxide and the calcite forms calcium bicarbonate, raising the pH and the hardness while reducing the free carbon dioxide content. With this equipment it is possible to bring the pH up to 7.2 or 7.3[8] which, of course, does not completely neutralize all of the carbon dioxide and still may leave the water corrosive. Neutralizing filters are particularly useful for corrosion control in smaller buildings, such as single family houses, for which the more effective treatment methods are too expensive or require the use of too complex equipment.

A generally more effective method of combating corrosion in building piping systems is through continuous proportional feeding of soluble inhibitors, such as sodium silicate, to the water as it enters the building. The silicate is added in amounts equivalent to 8-12 ppm as SiO_2, forming a protective film, predominantly silica, on the inside surfaces of the pipes. With proper operation and control, this film remains thin and does not build on itself. Lehrman and Shuldener have shown that the mechanism of film formation involves a chemisorption between silica and metal corrosion products.[9,10] Polyphosphates also may be added to water for this purpose.[11]



PROPER PROPORTION OF TREATMENT CHEMICALS IS ASSURED BY USE OF CHEMISTAT IN WATER LINE.

THOROUGH ANALYSIS IS NECESSARY ON SAMPLES SO THAT PROPER TREATMENT CAN BE SPECIFIED.



The addition of chemicals to a potable water system presents two potential hazards: possible toxicity of the water treatment chemicals and possible introduction of pathogenic organisms. Therefore, treatment of domestic water systems in buildings involves public health.[2] New York City[1] and Detroit[3] have established regulations controlling the conditions under which chemicals may be added to the potable water supply in a building.

N.Y.C. Code Requirements

The New York City Sanitary Code requires licensing of all persons or companies adding chemicals to the potable water supply in a building, specifies the harmless chemicals that may be used, and requires approval of the equipment used for adding the chemicals. The licensee must be a chemist or chemical engineer with at least five years experience in work closely related to the chemistry of water, must have a chemical laboratory equipped to carry out specified analyses in accordance with standard methods, and must follow specified procedures in the maintenance of records.

Treatment chemicals may be fed to the water by proportionating pumps actuated by meters. However, the cost of such equipment is frequently too

high for these applications and, in addition, many urban buildings are in charge of itinerant superintendents, so that no maintenance help may be available when failure occurs. Therefore, a diffusion type feeder has proved much more satisfactory for this service .[12] This feeder functions by means of the small pressure differential created by an orifice disc inserted in the water main. Extensive tests by the New York City Board of Standards and Appeals have demonstrated that this equipment will not feed excessive amounts of chemicals to the water even under conditions of vacuum or reverse flow.

Corrosion Control

Actually, the control of corrosion in building piping systems is a complex problem which rarely is solved by chemical methods alone. The mechanical features of the piping system and the operating conditions have a great bearing upon the effectiveness of corrosion control by chemical treatment. Shuldener recently described in considerable detail the design, operating, and maintenance factors that affect corrosion in piping systems.[13]

Magnesium anodes sometimes are used for preventing corrosion of certain pieces of water handling equipment in buildings. These sacrificial anodes are quite effective with some waters but are less effective in waters of low mineral content, such as those found in the New York and New England areas.[14] Furthermore, the anodes do not extend protection to the pipes in buildings because the small diameter of the pipes precludes insertion of anodes. Where the water composition is appropriate, magnesium anodes can be quite effective in controlling corrosion of hot water storage tanks and similar equipment.

Although space and cost limitations ordinarily would rule out vacuum deaeration for the control of corrosion in urban buildings, at least one hospital is successfully using this method for protection of a war-time black iron piping system carrying a corrosive water.[15]

Over large areas of this country the public water supplies are of sufficiently high hardness to warrant softening in many buildings in order to eliminate the difficulties encountered with washing and laundering, and the formation of scale in hot water generators and hot water lines. In such areas, the zeolite water softener is a well-known appliance. This particular water treatment method is probably familiar to more nontechnical people than any other because of its widespread use. Where scale control alone is the desired effect, the addition of small amounts of the polyphosphates often will suffice.

Off-Tastes and Discoloration

Circulating chilled drinking water systems and refrigerated drinking fountains sometimes are plagued by off-tastes or discolored water. These difficulties may be aggravated by the rather small usage of water from such systems which causes an unusually long time of contact between the water and the piping. Based on normal consumption rates, an office bubbler serving 25 people would use only about 0.75 gph. In one office a long run of pipe was of such large diameter and the consumption so low that the water took an average of a full week to cross the office from riser to fountain.

Discoloration by corrosion products frequently can be overcome by altering the piping system to improve circulation, by use of more resistant piping materials, and by regular flushing. For elimination of serious off-tastes, it is sometimes necessary to chlorinate the system to destroy bacterial growths.

If off-tastes persist or if the municipal water supply has an off-taste from time to time, filters containing granular activated carbon can be installed on the drinking water line to absorb the undesirable taste-forming materials.[5] The original taste often results from bacterial growths and, in time, the filter may develop a serious slime condition as a result of these same bacteria. Accordingly, a regular backwashing and chlorination procedure is recommended for activated carbon filters.

Boiler Waters

The well-known reasons for the treatment of water for industrial boilers apply equally well to boilers in urban buildings. Here the problems differ from the usual industrial boiler water problems in that the boilers are usually low pressure heating boilers. The amount of make-up water fed to heating boilers is small and, therefore, the total amount of scale deposited will be small even with quite hard waters. On the other hand, the feedwater is not deaerated and the steam heating systems are so installed that they frequently offer opportunity for the condensate to pick up oxygen on each cycle. Then corrosion becomes the principal water-caused difficulty.

Among the chemicals used for the treatment of heating boilers in urban buildings are various alkalies, phosphates, silicates, and chromates. The particular treatment required will depend upon the composition of the make-up water and the operating conditions.[24]

Control Important

When troubles develop in low pressure heating boilers carrying treated water, these troubles generally result from a lack of control. Even when an effective corrosion inhibitor has been added to the boiler water, it is necessary to check the water composition at regular intervals to be certain that the required concentration of treatment chemical is present and that no conditions have developed that might lead to scale formation. With excessive steam or condensate losses, particularly with harder water supplies, it is sometimes necessary to treat the water in a heating boiler as though it were a high

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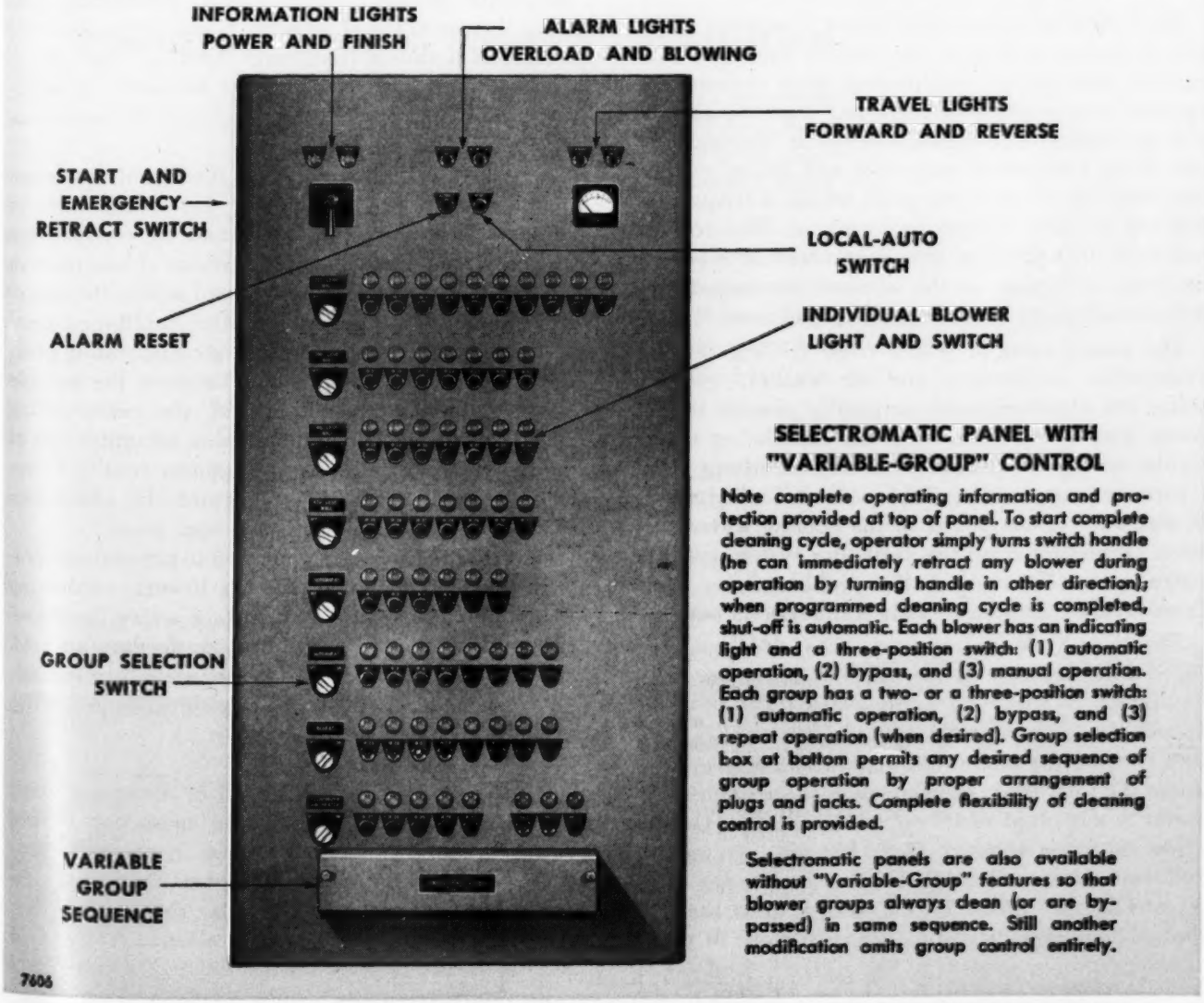

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Selectromatic panels are also available without "Variable-Group" features so that blower groups always clean (or are bypassed) in same sequence. Still another modification omits group control entirely.

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pressure unit. Every effort must be made to minimize losses of steam and condensate in heating systems to lessen both corrosion and scale formation.

For those buildings in which higher pressure and higher make-up boilers are operated, the usual methods of water treatment for both corrosion and scale control are applied. These have been discussed thoroughly in numerous books [22, 23] and papers [19, 25] on water treatment and boiler operation.

Despite the widely held belief that hot water heating systems and other closed circulating systems do not require water treatment, experience has shown otherwise.[16] Very few closed systems are actually watertight. Make-up water must be fed in appreciable amounts, and it carries dissolved oxygen and scale-forming materials. Venting to eliminate the dissolved oxygen becomes increasingly difficult in lower temperature heating or cooling systems. Treatment of such systems by pH control, with the feeding of chromates or sulfites, has been effective in minimizing corrosion.

Air Conditioning

The fastest growing urban water treatment problem is the protection of circulating cooling water systems used for air conditioning. Such systems are extremely susceptible to corrosion, scale formation, and development of slimes. Corrosion shortens the life of the equipment, and scale and slimes reduce operating efficiency to the point where it frequently will fail to meet desired performance. The serious nature of this problem was recognized in a recent day-long conference at the national meeting of the American Society of Refrigerating Engineers.[18]

The evaporation of water from cooling towers, evaporative condensers, and air washers concentrates the dissolved solids originally present in the water and, at the same time, the circulating water scrubs enormous quantities of air, absorbing from it corrosive gases and insoluble sediment which tends to settle at various points in the cooling water systems. Depending upon the particular system and the make-up water involved, the problems may vary from severe corrosion to scale formation or both.

The New York metropolitan area, for example, faces a particularly acute corrosion problem with equipment of this type.[17] The city's Catskill water is sufficiently low in total solids so that the windage loss from evaporative cooling equipment usually limits the total solids concentration in the circulating water to a point at which no scale will form. On the other hand, the quantity (2,200,000 tons per year of sulfuric acid equivalent)[21] of sulfur dioxide discharged into the air in New York City is so great that the limited buffering capacity (approximately 10 ppm) of the alkalinity present in the water is inadequate to cope with the sulfur dioxide scrubbed from the air. As a result, the pH of untreated circulating waters in the area frequently falls below 3, causing extensive damage to metal equipment. Corrosion failures of copper refrigerant condenser tubes within a single air conditioning season are not unusual.

A wide variety of treatment chemicals and some "miracle" gadgets are offered to combat the water-caused difficulties which develop in air conditioning systems. However, experience has shown that reliable results can be achieved only by a combination of controlled chemical treatment and proper mechanical operation. The corrective procedure must include diagnosis of the actual or probable water-caused problems, selection of suitable treatment chemicals and concentrations, proportional feeding of chemicals and, above all, control. Mechanical maintenance must include minimizing of water losses and regular cleaning and painting.

Recommended Treatment Methods

Control of pH plus the use of inhibitors, particularly chromates, will reduce corrosion losses in air conditioning systems by as much as 95 percent.[17] Other corrosion inhibitors, silicates and nitrites, sometimes are used when special conditions preclude the use of the chromates. Some of the chemical treatment methods frequently used in large industrial cooling installations cannot be safely or effectively used in urban buildings because of the absence of adequate control measures.

Methods for the proportional feeding of treatment chemicals are well-known for the larger sizes of equipment, but protection of small air conditioning units has stimulated the development of inexpensive feeding devices which can be placed within the equipment and used with a minimum of installation cost.

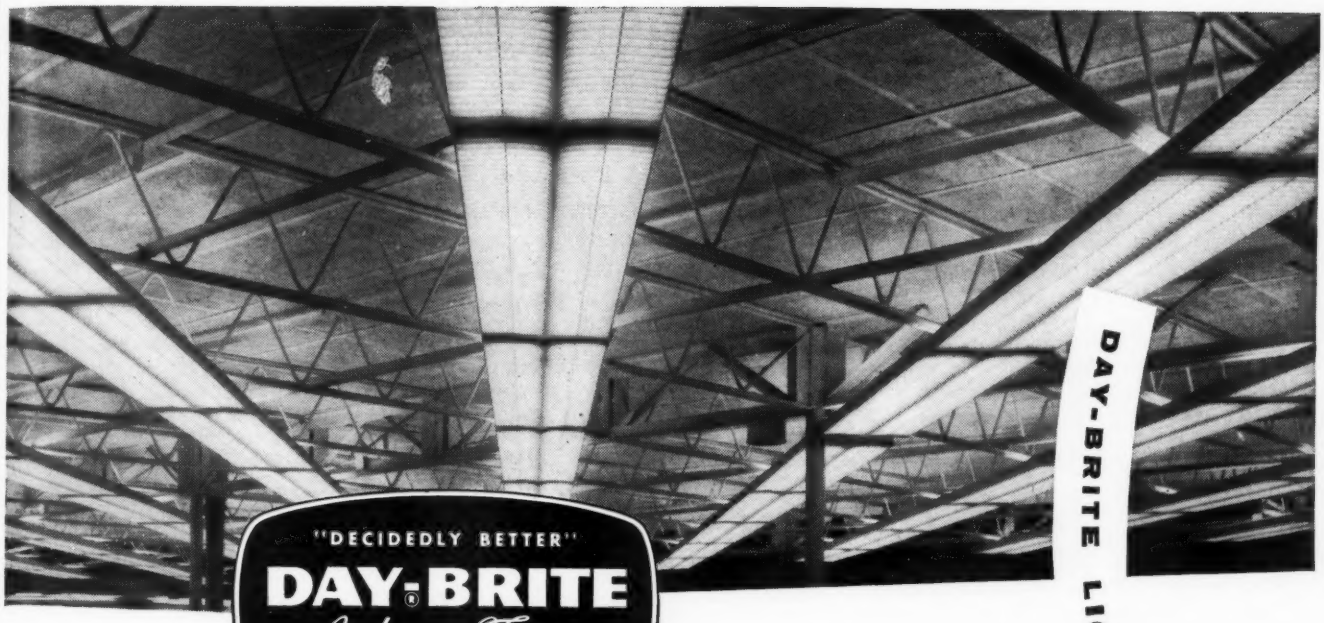
Although plumbing codes and good operating practice prohibit cross-connections between the potable water system in a building and the recirculating cooling water system, the complex accumulation of piping in urban buildings sometimes results in accidental cross-connections. Fortunately, chromates serve as their own indicators in such cases.

Several procedures can be used to prevent or minimize scale formation in cooling towers — softening the make-up water; adding surface active agents together with adequate bleeding; or feeding an acid, such as sulfuric acid, to convert scale-forming calcium bicarbonate into more soluble calcium sulfate.

Avoid Acid-Feeding

Although acid-feeding is used in many industrial cooling water installations, the need for special equipment and personnel skilled in chemical handling generally precludes its used in the cooling systems of urban buildings. Moreover, the required control equipment is expensive in relation to the total cost of the average air conditioning installation.

Even a theoretically simple operation, such as continuous bleeding from a recirculating evaporative cooling water system for limiting the dissolved solids



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concentration, is controlled with difficulty in air conditioning systems of buildings. In order to minimize both scale formation and water losses, rather low bleed rates are required. Continuous bleeding of a small fraction of a gallon per minute, as required in many air conditioning systems, is generally a difficult operation because of the ease of clogging of partly closed valves used to control the bleed. Simple, non-clogging devices utilizing hydraulic principles have been developed recently. They are effective in providing continuous uniform bleeding or blowdown even at very low flow rates.

Bacterial growth resulting in slime formation can be troublesome in air conditioning systems. A lightweight layer of slime can behave like a thick layer of scale because of its insulating effect in refrigerant condenser tubes. Slimes can clog strainers and reduce water circulation, clog air washers and reduce air flow, and impart odors to conditioned air passing through the washers.

Chemical treatment can be very effective for the control of slime and algae. Intermittent or continuous chlorination commonly is used for this purpose. In urban air conditioning systems, hypochlorites are used much more frequently than chlorine itself because of equipment cost. Pentachlorophenates and other organic slimicides and fungicides also are used. Chromates added for corrosion control also are reasonably effective as slime control agents where slimogenic conditions are not too severe.

Slime in air washers is particularly difficult to eliminate. Removal of slime from finned tubes often requires vigorous methods such as high pressure steam jet cleaning. Furthermore, the most effective slimicides generally cannot be used in air washers because they may produce odors or otherwise contaminate the air passing through the equipment to occupied areas.

Swimming Pools

Water treatment for indoor swimming pools is required to meet rather rigid public health regulations in most states. Generally the recirculated water must meet or closely approach drinking water standards. In order to achieve this the water is recirculated, with treatment for pH control, filtration, and sterilization. Diatomite filters are being used increasingly for swimming pool clarification.

Sprinkler Systems

So-called wet sprinkler systems, like other closed systems, theoretically should not require treatment. Actually, such systems can suffer serious corrosion damage if there is any sizeable water flow. In one application a large hospital had to re-pipe a large part of its sprinkler system after less than 10 years service because leaky check valves and pressure differences permitted water flow where there should have been none. However, the water in these systems rarely is treated chemically although Darrin[20] mentions that chromate inhibitors have been used.

Hydraulic Elevators

The water in surge systems, such as are used by hydraulic elevators, can be aggressive, particularly to the polished metal of the hydraulic piston. Chromates have been applied for corrosion control,[20] but soluble oils are much more commonly used.

Summary

Water treatment problems in urban buildings are more prevalent than is usually realized. Solutions to water problems in these buildings may differ considerably from the solutions to similar problems in industrial plants or other locations because of unusual space limitations, legal requirements, and other special considerations. Nevertheless, water treatment specialists have developed satisfactory procedures for correcting the various water-caused difficulties that can develop in urban buildings. ▲▲

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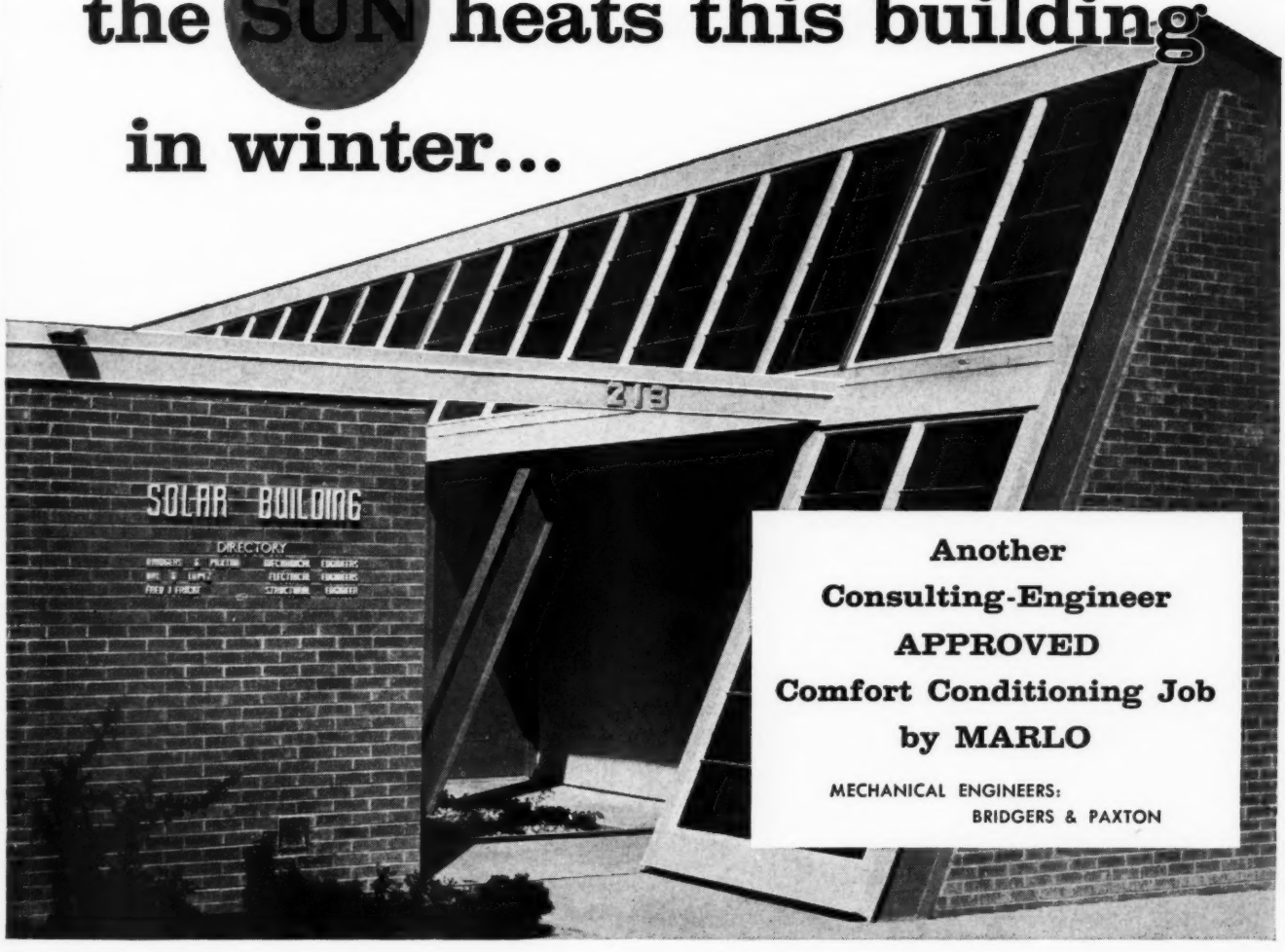
the SUN heats this building in winter...



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MECHANICAL ENGINEERS:
BRIDGERS & PAXTON

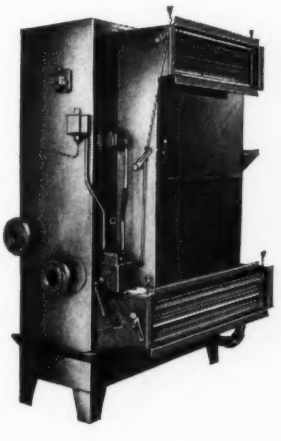
MARLO helps cool it in summer

This unique building in Albuquerque, N. M., is believed to be the first solar-heated commercial building in the United States.

Marlo heat transfer equipment is an important part of this installation which combines solar heating, evaporative cooling and an auxiliary heat pump.

Occupants of this unusual building include its owners and designers, the mechanical engineering firm of Bridgers & Paxton. Architects were Stanley and Wright, general contractor was Paul Priest. All are of Albuquerque.

Marlo equipment has played an important role in many distinctive air conditioning installations in this country and abroad. To learn how it can serve your needs efficiently and dependably, write us today.



MARLO coil co.

SAINT LOUIS 10, MISSOURI

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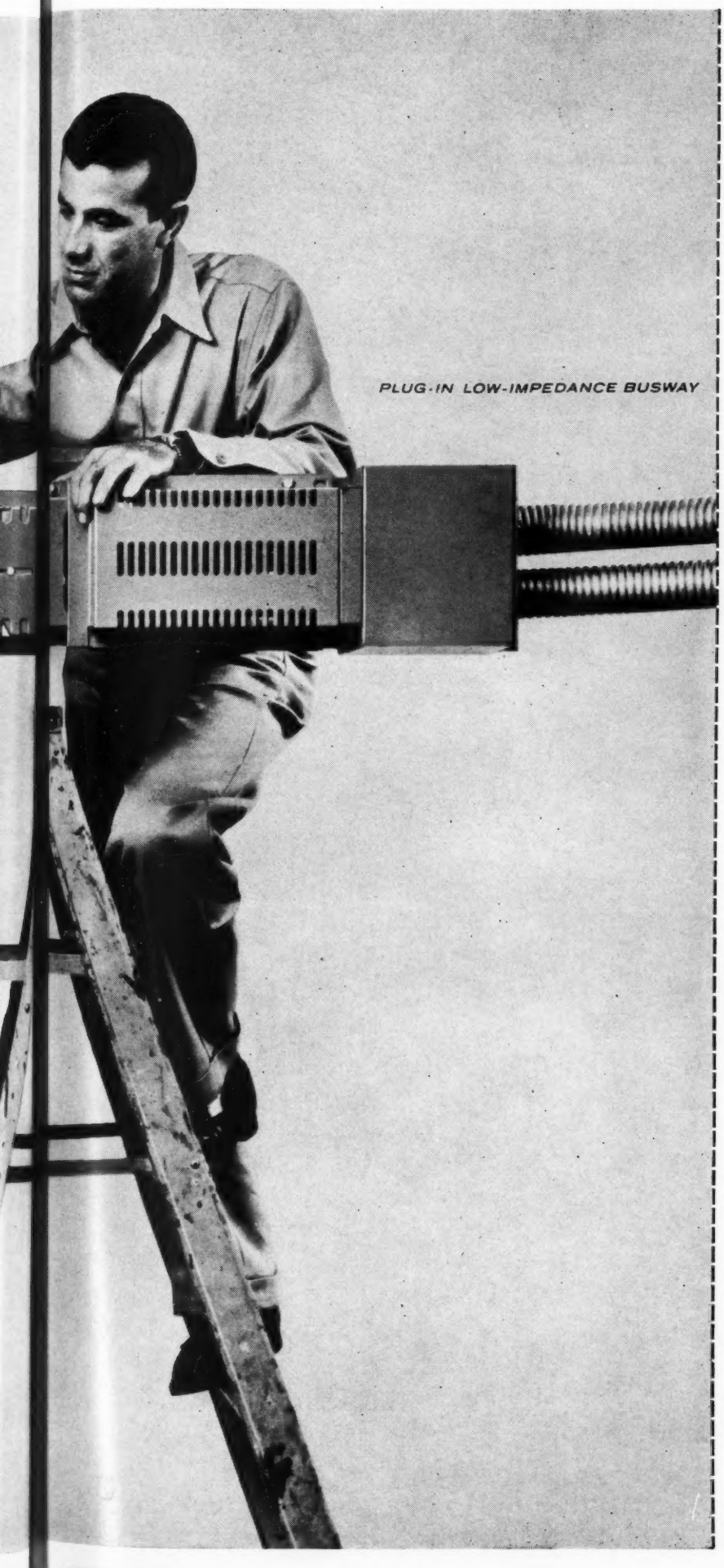
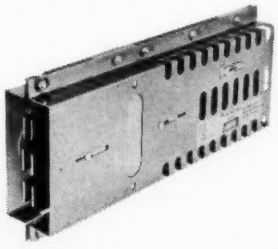


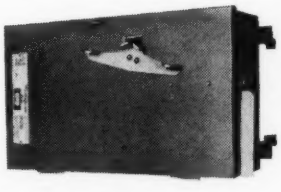
Construction details of Uni-bus, new power distribution system

Many reasons make Uni-bus unique in the busway field. Three exclusive features are detailed here:



Safety slide . . . Interlocking slide keeps plug-in openings closed until plug-in device is fastened to busway. Device cannot be removed when slide is opened. System has 12 outlets per 10-foot length.

Flexible connector . . . One unit does the job normally requiring many special fittings in other busways. The connector consists of two attachment boxes joined with flexible conduit and cable.

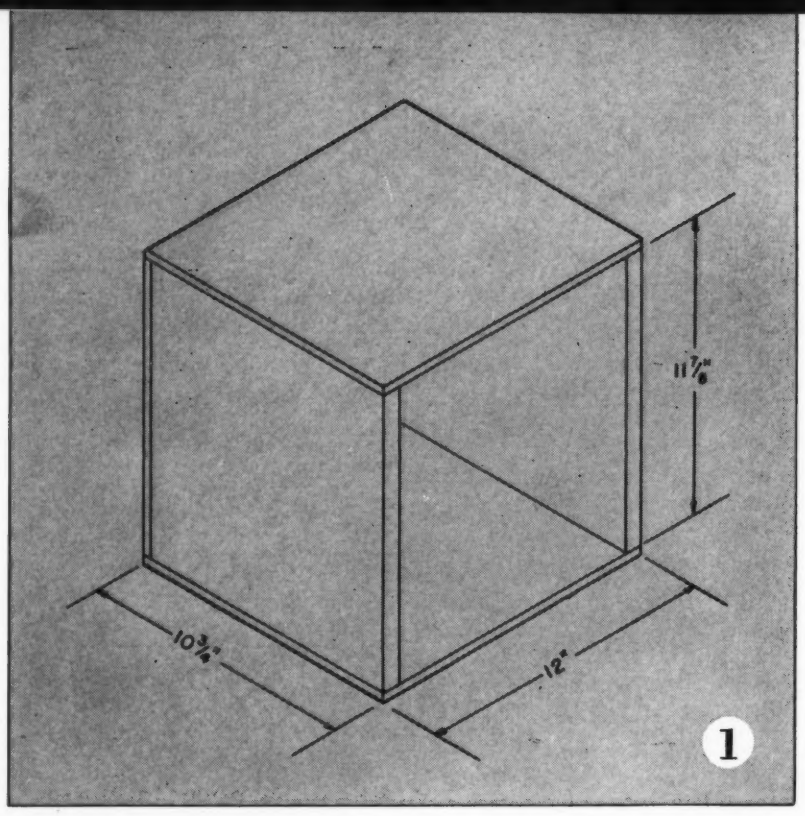


Uni-bus plug . . . Here is convenience and safety in one plug-in system. When cover is open no live parts are exposed. Contacts are visible in open position for positive identification. Contacts interlock so circuit is not opened or closed on bus bars.

At left is an illustration showing why Uni-bus is your best power distribution buy.

YOU CAN BE SURE...IF IT'S

Westinghouse



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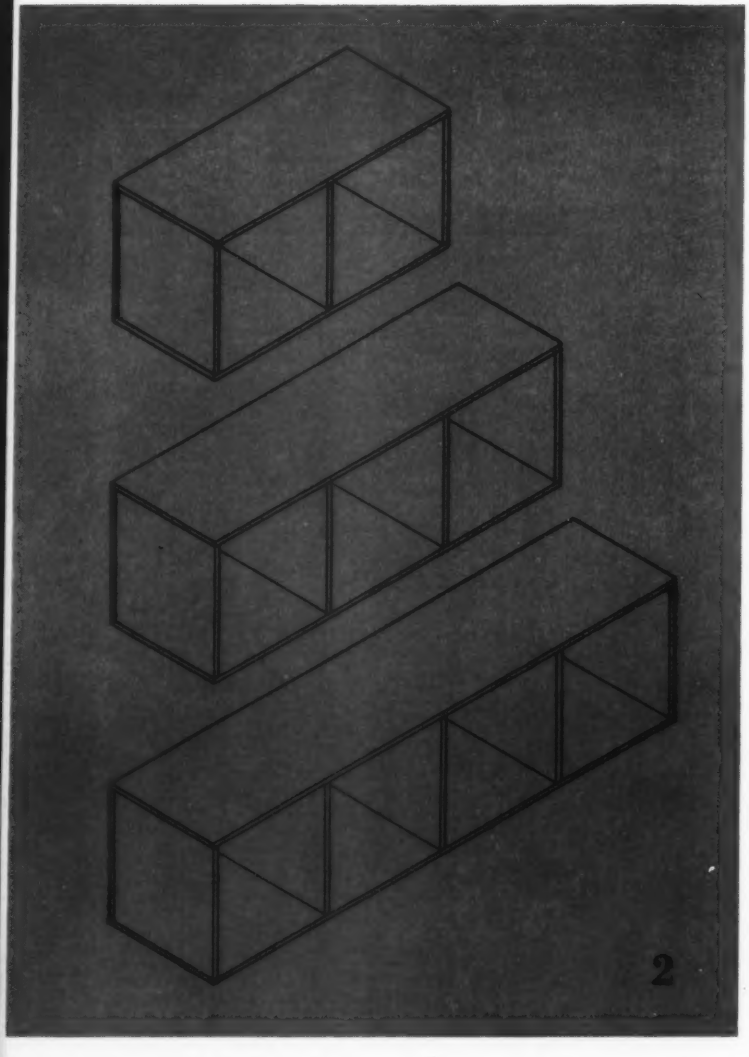
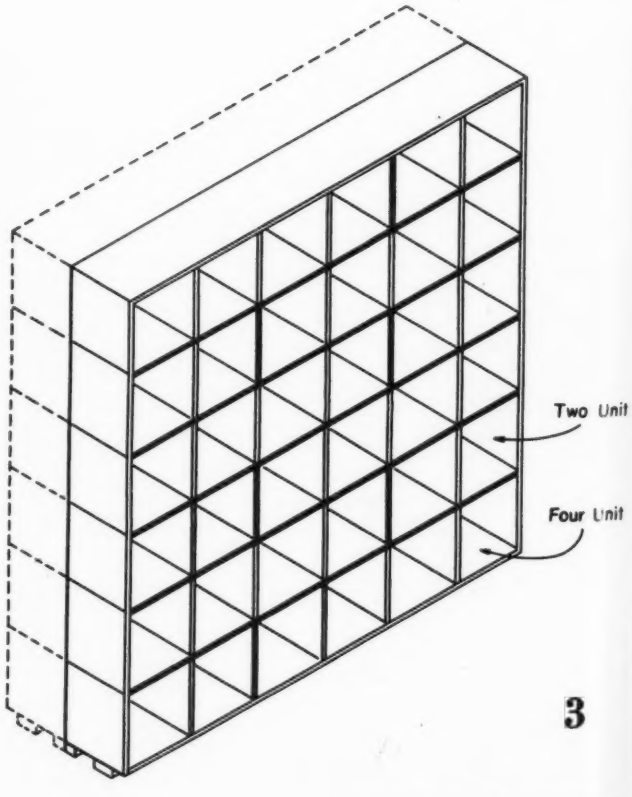


2

THE CUSTOM BUILT FURNITURE SHOWN IN THE DRAWINGS AND DESCRIBED IN THE TEXT IS DESIGNED SPECIFICALLY FOR A CONSULTING ENGINEER'S OFFICE. MUCH OF IT IS BASED UPON THE MODULAR SECTION IN THE DRAWING ABOVE.



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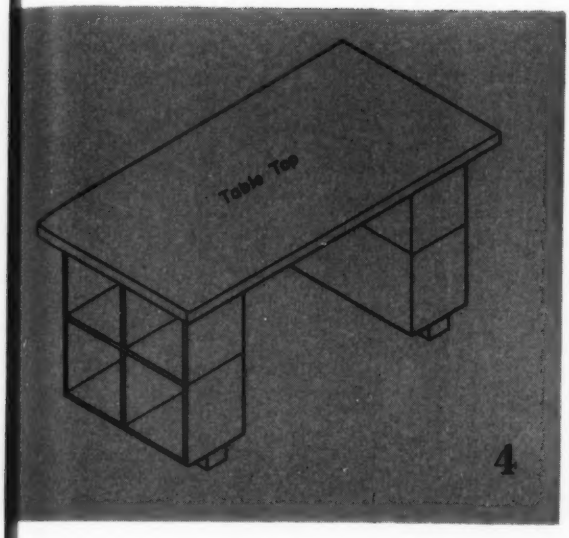

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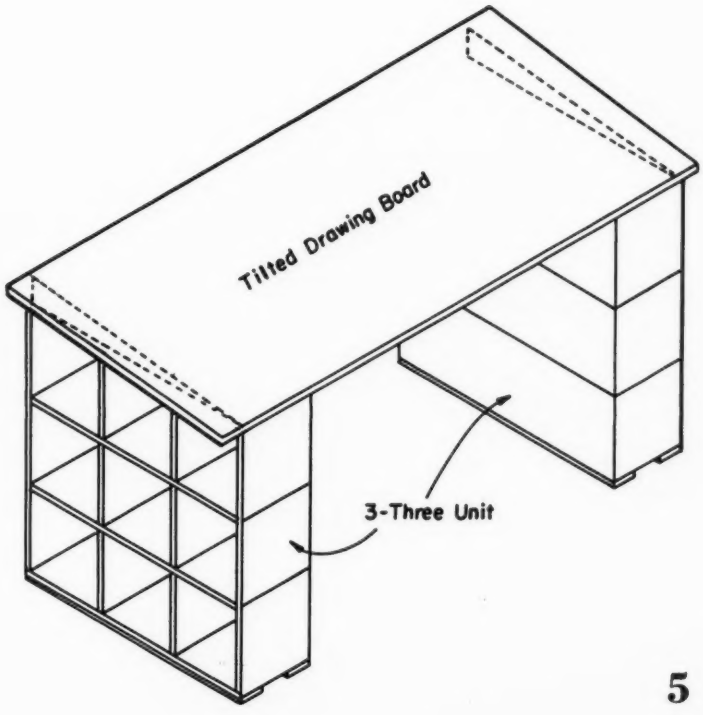

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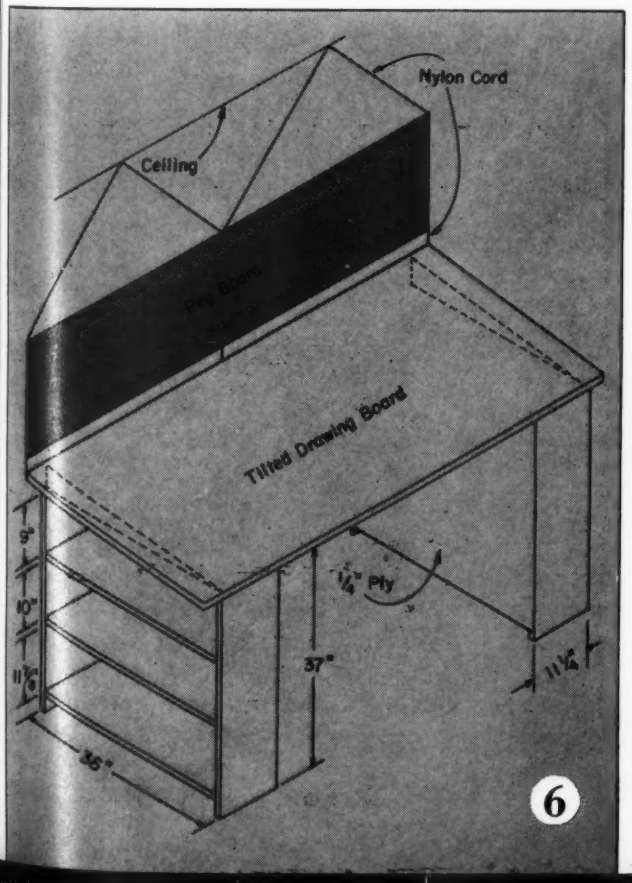
Furnishing an Engineer's Office

WOODROW W. RAMSEY, Ramsey & Reeves



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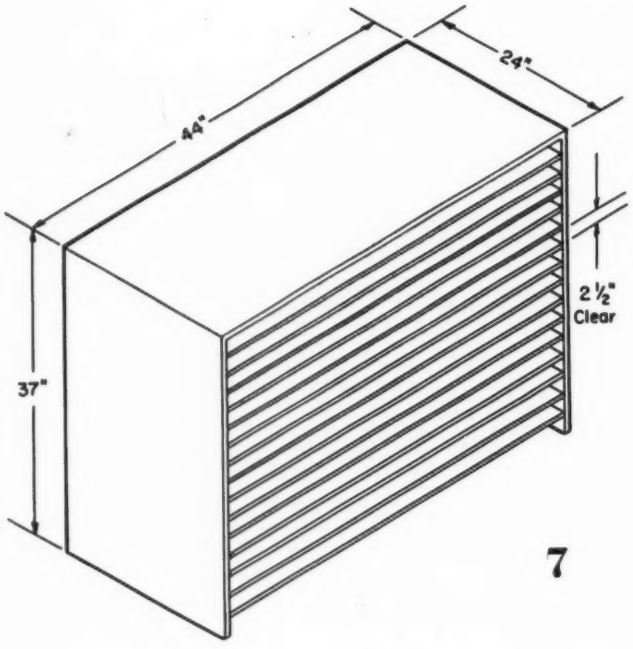
WHEN A CONSULTING engineer attempts to furnish his office appropriately he will discover that very little office furniture has been designed with the particular needs of the consulting engineer in mind. For example, standard office bookcases generally are unsuited to large manufacturers' catalogs.

Ce exclusive

To solve this and other problems of the type, we began to design some of our own furniture and found that we could supply the needs of our office attractively and efficiently at a very low cost.

Basic Module

We started by designing a basic modular section for filing books and catalogs. This basic section is shown in Fig. 1. The clear inside height of 11⅞



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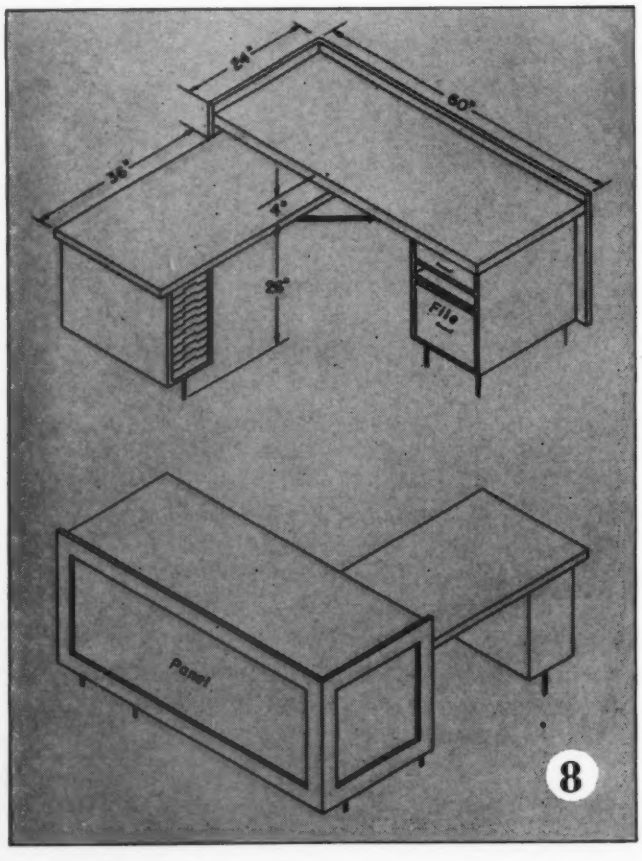
inches is sufficient to accommodate most catalogs without undue waste of space. The design permits four backs to be obtained from a standard, 48-inch wide plywood sheet. The width of 12 inches between vertical spaces permits catalogs or books to be removed without those still in place falling over. Fig. 2 shows how this basic module can be expanded to



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24, 36, or 48-in. width. The 48-in. wide case is the maximum that can be handled by hand when full of books or catalogs.

Multiple Arrangements

These pieces can be used in many ways so that they become more than catalog files. They can be arranged in single or double rows and to any desirable height to form office partitions. Such a partition is shown in Fig. 3.

Groups of units also can be used to support table tops or drafting boards. Heights can be adjusted by inserting 2 x 4, 4 x 4, or 4 x 6 sleepers beneath the units or by raising them on short legs that can be purchased from any hardware store. Fig. 4 shows a table constructed in this manner, while Fig. 5 shows a tilted drawing board on which a wedge has been inserted between the units and the drawing board to give it the proper tilt.

Drafting Table With Pegboard Screen

A slightly different design for a drafting table is shown in Fig. 6. Here, instead of using the standard units, a more conventional bookcase is used for the end supports.

We have found that a piece of pegboard suspended from the ceiling and attached to the top edge of the drafting table is a most practical addition. Ordinary wood golf tees can be inserted into the pegboard to support drafting equipment, data sheets, and reference drawings. The screen also has an acoustical value and gives the draftsman a certain degree of privacy. When painted a flat white, it improves the lighting on the board and diffuses the light.

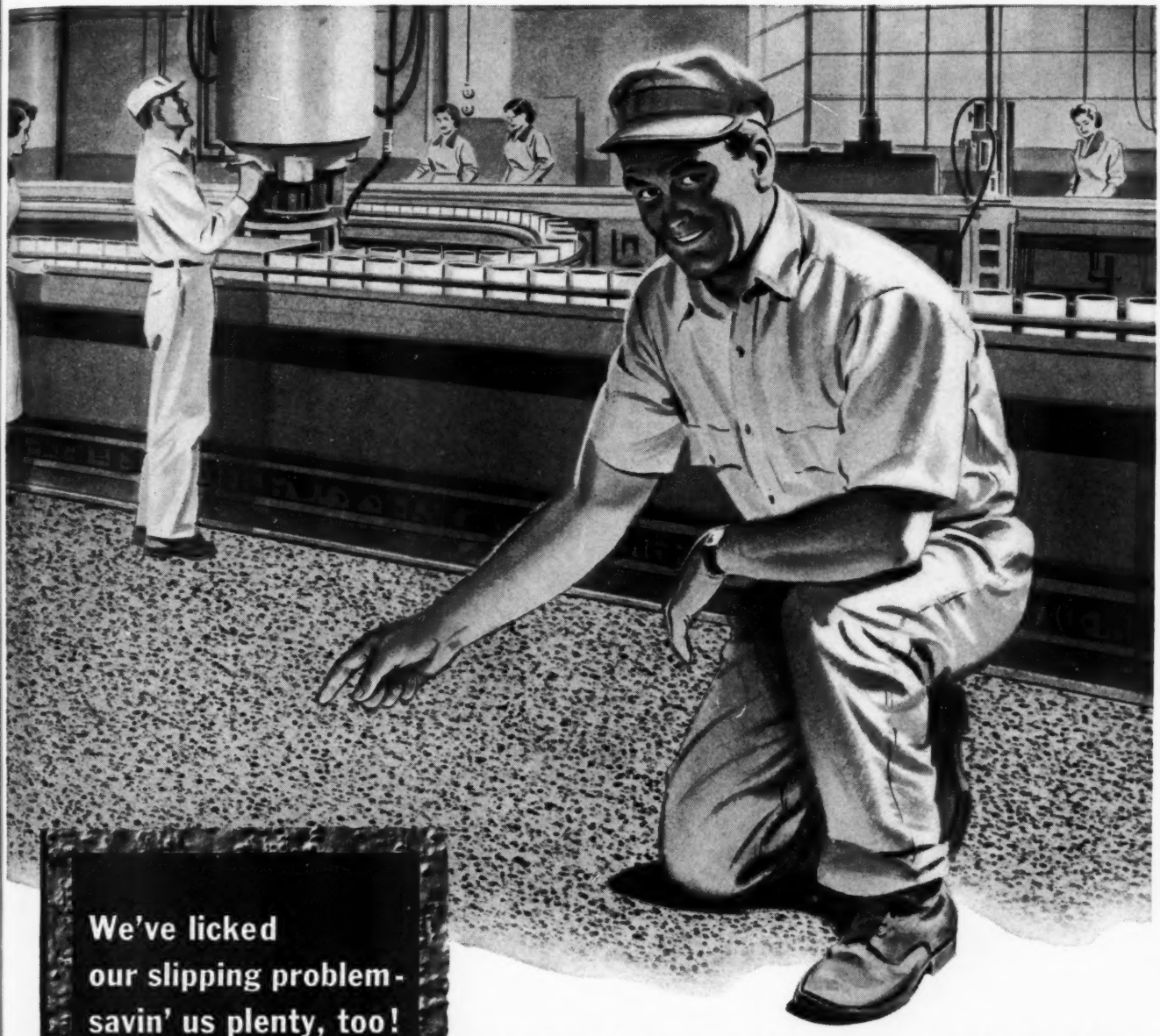
Drawing Files

We also have had built for us a number of wooden files for drawings. Fig. 7 shows the dimensions of the size we use, but this could be varied according to any office's particular needs. We bind the tracings or prints in hinged cardboard covers and label them to correspond with numbered shelves in the files.

Receptionist Desk

Having found office equipment of our own design to be so practical and inexpensive, we went a step further and designed a receptionist desk as shown in Fig. 8. The lower level desk is for typing, and paper supplies are filed at the left of the typist. The two desk tops are made from 2-in. flush doors and covered with laminated plastic. The legs can be of either wood or metal dowels.

This receptionist's desk goes slightly beyond our original idea of making our own furniture for the office where standard office furniture is not available or not as well suited to our particular needs. However, it illustrates that special office equipment is rather easy to design, and any good carpenter or cabinet maker can assemble the pieces. ▲▲



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He's talking about ALGRIP—A.W. ALGRIP—the world's only abrasive rolled steel floor plate that provides super-safe footing under the *most hazardous* slipping conditions—on flat *or inclined* surfaces.

ALGRIP licks slipping and skidding hazards thoroughly by providing thousands of abrasive traction particles at every step. It's made by a patented process in which a grinding-wheel type of abrasive is rolled—*not coated*—to a controlled depth as an integral part of tough steel plate. Usage merely exposes more abrasive.

Look around for slipping hazards and make a test installation in your worst area. It'll save you plenty, too, as accident and insurance rates go down. Use it as an overlay or as independent flooring. ALGRIP fabricates easily and requires no maintenance.

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Conshohocken, Pa.

Please send A.W. ALGRIP Booklet AL-S32

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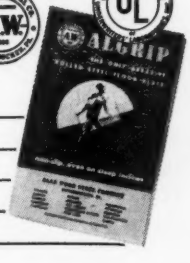


OTHER PRODUCTS:
A.W. SUPER-DIAMOND economy rolled steel floor plate—Plates—Hot and cold rolled sheet and strip—(Alloy and Special Grades)

Survey of The Profession 1957

Here are the results of CONSULTING ENGINEER'S 1957 Survey of the Profession

Facts and figures providing vital statistics on the private practice of engineering in the U. S.

THOSE GROUPS whose job it is to gather statistics seem to have overlooked the consulting engineer. The U.S. Department of Commerce, the world's greatest compiler of statistics, has no data on consulting engineers or their activities. Among the millions of figures on construction compiled by the Department there is not one that refers to the consulting engineer. Nor do any of the private statistical firms collect such information. No one knows much about consulting engineers as a professional group.

The results of the survey published here answer some of the more frequent questions asked about the profession by consulting engineers themselves and by others who deal with them, and according to all rules of statistical compilation, the answers should be reasonably accurate. The data presented is based upon a 1000 unit sample of questionnaires returned by consulting engineer firms in the United States. This is a large enough sample to make the conclusions reliable. Wherever the results are broken down into sections of the country, the data are based on correspondingly smaller samples, and when broken down into states, the samples become, in some instances, so small as to be meaningless. Wherever that is true, data have been omitted from the tables.

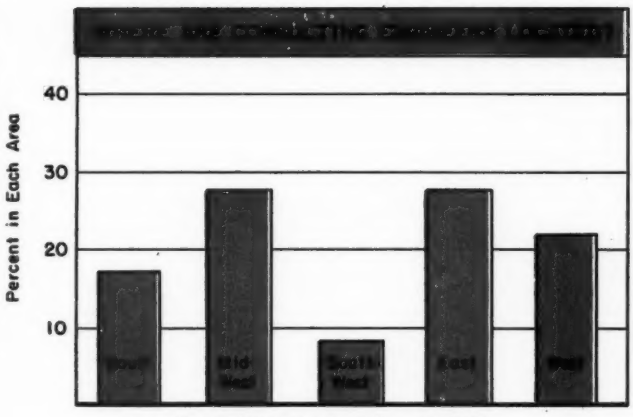
The questionnaire sent to consulting engineers was divided into four parts. Part I had to do with the organization of consulting engineer firms. Part II investigated the fields in which consulting engineers worked, while Parts III and IV asked questions about physical space occupied by the firm and opportunities today for engineers entering into private practice. This report deals only with the answers to Part I. The report on Parts II-IV will be published in the February issue.

Where Are They?

One question was answered that was not asked in the questionnaire. By making a geographical breakdown of the returns, it was possible to determine where consulting engineers are located. It was found that 27 percent of the firms are located in the Midwest, 27 percent in the East, 21 percent in the West, 17 percent in the South, and 8 percent in the Southwest. (See Fig. 1 for regional groupings of states.) This does not take into account variations in average size of firms in different parts of the country. Many of the very large firms are in New York City and, therefore, the East would show a higher figure if adjustment were made for firm size. There are also a few very large firms on the Coast.

Size of Firms

One of the frequently asked questions is, "What is the average size of a consulting engineer firm?" Table 1 gives the answers. Figures are given state by state and region by region. They show size when founded, size at present, maximum size, and minimum size. These average sizes are further subdivided according to partners or principals, engineering employees, and other employees. For example, when



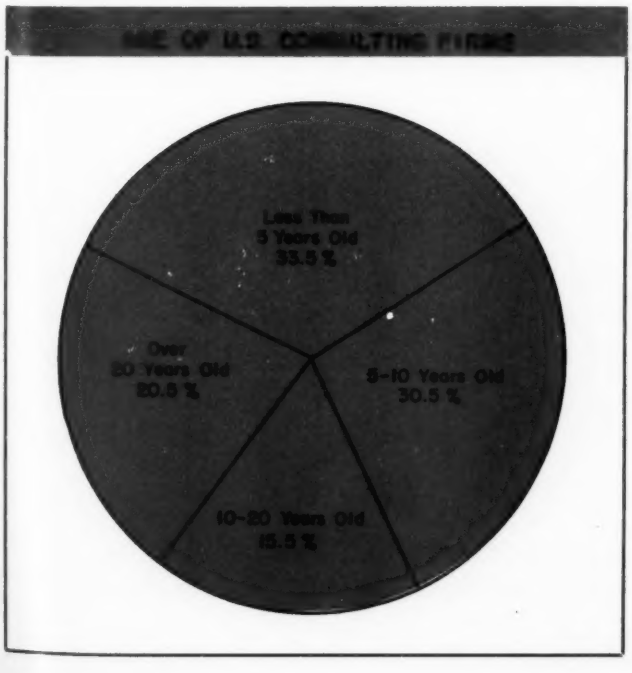
See Table 1 for Grouping of States

founded, the average firm in the South consisted of 4.2 persons of which 1.5 were partners or principals, 1.4 were engineer employees, and 1.3 were other employees. Naturally, there has been considerable growth in firm size so that at present consulting engineer firms in the South have an average of 2.1 principals or partners, 11.6 engineering employees, and 7.7 other employees making a total size of 21.4.

At the present time the average firm in the Midwest has 21.5, the Southwest, 18.9, the East, 39.7, and the West, 44.2. Note that the average size for the entire United States is 31.1 at present.

Note the enormous growth of consulting firms when comparing their original size with their size today. The average firm in the United States started with a total of 4.8 people. In 1956 this had grown to 31.1 — a growth of 650 percent.

The average minimum size reached was 4.1, slightly below the 4.8 figure for size at time of origin. This indicates that the average consulting firm in the United States started off quite small, got slightly smaller at some time during its history, then increased heartily after the low point was reached. The maximum figure of 50.3 as average for the United States is probably fairly accurate. It is well known that consulting firms have peak periods, and it is not unreasonable to believe that these peaks have reached a high that would make the average 50 persons per firm. However, individual state figures are less reliable in this column. Take, for example, the average maximum size for New York State. The figure of 572.9 seems extremely high. It is thrown out of line by the average of 533.3 non-engineering employees. But one firm in New York at one time had 30,000 non-engineering employees on its payroll while another had 25,000. A similar situation occurred in the District of Columbia. If these few large firms were removed from the calculations, the figure for New York would be more in line with other states. Also, the 102.5 average peak figure for the East would come down to nearer 50.



Note that the East and the West have grown more in number of persons per firm than other sections. The East went from an average of 4.8 persons per firm when the firm was started to a current average of 39.7. This is an increase of 8.2 times in comparison with the national average increase of 6.5. The West went from 6 to 44.2, an increase of 7.4 times.

Age of Consulting Firms

Almostly exactly one-third of the consulting engineering firms in the United States are five years old or less. Another third are less than ten years old, while 15.5 percent are ten to twenty years old, and 20.5 percent are over twenty years old. This holds generally true by regions although, as might be expected, there are a few more old firms in the East than in any other part of the country. On the other hand, the Midwest has a slightly higher percentage of firms less than five years old.

The years between 1946 and 1951 showed the greatest growth in the Southwest and West. This ties in logically with the heavy population movement to the West and Southwest immediately after the last War.

Among the individual states, Florida shows the greatest percentage growth in the last five years. Florida's rival state, California, does not show up as well percentage-wise in the past five years, but she is ahead of most other states in percentage gained between 1946 and 1951. It must be kept in mind, however, that these are percentage figures and that there were actually, in number, almost twice as many firms organized in California in the last five years as there were in Florida.

To put the final results for the U.S. another way, the last five years saw an increase of 50 percent in the number of firms of consulting engineers. This is an astounding rate of growth and one that can be match-

TABLE 1 — SIZE OF CONSULTING ENGINEER FIRMS*

State	Size When Founded				Present Size				Maximum Size				Minimum Size			
	Partners	Engineers	Others	Total	Partners	Engineers	Others	Total	Partners	Engineers	Others	Total	Partners	Engineers	Others	Total
Alabama	1.5	2.0	1.4	4.9	1.9	8.2	3.6	13.7	2.0	13.5	10.5	26.0	1.5	1.0	1.3	3.8
Arkansas	1.4	0.6	0.2	2.2	1.4	2.1	0.8	4.3	1.8	2.2	0.8	4.8	1.4	0.6	0.2	2.2
Florida	1.5	1.0	1.2	3.7	1.8	4.3	2.8	8.9	1.8	8.3	7.1	17.2	1.5	1.0	0.2	2.7
Georgia	1.5	1.0	1.1	3.6	2.5	16.4	6.0	24.9	2.5	22.2	10.4	35.1	1.5	1.0	1.1	3.6
Kentucky	1.4	1.4	2.8	5.6	1.4	8.3	6.8	16.5	1.4	15.0	11.0	27.4	1.4	1.0	2.0	4.4
Louisiana	1.5	1.5	1.0	4.0	1.7	5.0	3.8	10.5	1.7	6.7	4.2	12.6	1.5	1.2	0.6	3.3
Mississippi	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Missouri	1.3	1.8	1.9	5.0	2.2	2.5	17.6	22.3	2.2	5.0	37.0	44.2	1.3	0.9	1.2	3.4
North Carolina	1.4	1.0	1.8	4.2	2.2	8.0	9.6	19.8	2.2	8.1	11.2	21.5	1.3	1.0	1.8	4.1
South Carolina	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Tennessee	1.5	0.7	1.0	3.2	2.9	4.1	3.6	10.6	2.9	10.0	10.0	22.9	1.5	0.7	1.0	3.2
Virginia	1.5	1.7	2.3	5.5	2.6	2.3	17.4	22.3	2.9	43.0	52.0	97.9	1.5	1.7	2.3	5.5
West Virginia	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
SOUTH	1.5	1.4	1.3	4.2	2.1	11.6	7.7	21.4	2.2	17.6	16.1	35.9	1.4	1.1	1.1	3.6
Illinois	1.8	2.2	1.7	5.7	2.4	15.2	9.2	26.8	2.5	27.7	12.4	42.6	1.7	1.8	1.6	5.1
Indiana	1.7	3.0	0.5	5.2	2.2	8.4	5.7	16.3	2.2	8.4	8.0	18.6	1.7	1.0	0.5	3.2
Iowa	1.8	1.3	1.4	4.5	1.8	9.8	6.1	17.7	1.9	30.4	19.7	52.0	1.4	1.3	1.3	4.0
Kansas	1.4	1.4	1.4	4.2	1.6	13.5	6.0	21.1	1.6	15.3	10.0	26.9	1.4	1.4	1.3	4.1
Michigan	1.8	1.6	1.4	4.8	2.3	7.3	22.7	32.3	2.4	30.7	22.7	55.8	1.8	1.3	1.4	4.5
Minnesota	1.5	1.6	1.0	4.1	1.0	10.3	6.3	17.6	2.0	32.1	14.4	48.5	1.5	1.0	1.0	3.5
Ohio	1.5	1.0	0.8	3.3	0.7	10.0	8.8	19.5	2.0	14.0	9.4	25.4	1.4	0.9	0.7	3.0
Wisconsin	1.4	0.6	0.7	2.7	2.0	5.1	8.9	16.0	2.0	7.7	15.7	25.4	1.3	0.6	0.6	2.5
MIDWEST	1.6	1.4	1.1	4.1	1.6	10.3	10.6	21.5	2.2	22.0	17.6	41.8	1.5	1.2	1.0	3.7
Arizona	1.9	0.9	0.7	3.5	2.1	5.8	4.6	12.5	2.2	6.6	5.0	13.8	1.8	0.8	0.5	3.1
New Mexico	1.4	1.0	0.5	2.9	2.4	2.1	4.6	9.1	2.4	3.1	6.2	11.7	1.4	1.0	0.5	2.9
Nevada	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Oklahoma	2.1	3.3	3.0	8.4	2.3	7.7	11.0	21.0	2.3	23.9	17.6	43.8	2.0	1.3	2.0	5.3
Texas	1.7	1.1	1.6	4.4	2.1	10.2	10.9	23.2	2.1	12.0	29.4	43.5	1.7	1.1	1.1	3.9
SOUTHWEST	1.8	1.5	1.6	4.9	2.1	7.8	9.0	18.9	2.2	12.3	20.2	34.7	1.7	1.2	1.2	4.1
Connecticut	1.1	0.5	1.5	3.1	2.3	13.0	10.0	25.3	2.4	13.7	10.0	26.1	1.1	0.3	0.8	2.2
Delaware	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Dist. of Columbia	1.5	1.5	0.7	3.7	2.5	12.7	75.7	90.9	2.5	25.2	379.8	407.5	1.3	1.2	0.6	3.1
Maine	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Maryland	1.7	1.0	0.2	2.9	1.0	5.5	2.1	8.6	2.1	12.1	5.9	20.1	1.7	0.8	0.2	2.7
Massachusetts	1.9	0.9	0.7	3.5	2.5	4.8	13.5	20.8	2.6	51.0	14.0	67.6	1.8	0.9	0.5	3.2
New Hampshire	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
New Jersey	1.3	0.4	0.7	2.4	1.6	10.1	3.8	15.5	1.6	12.8	30.0	44.4	1.3	0.4	0.7	2.4
New York	1.8	1.8	2.0	5.6	2.4	21.9	10.9	35.2	2.4	37.2	533.3	572.9	1.6	1.7	1.3	4.6
Pennsylvania	1.8	1.8	1.8	5.4	2.2	17.1	17.6	36.9	3.3	22.6	28.9	54.8	1.8	1.8	1.8	5.4
Rhode Island	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Vermont	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
EAST	1.6	1.6	1.6	4.8	2.8	19.3	17.6	39.7	2.8	35.4	64.3	102.5	1.5	1.5	1.3	4.3
California	1.6	3.7	2.5	7.8	2.2	25.6	37.0	64.8	2.2	29.5	46.0	77.7	1.4	1.7	2.4	5.5
Colorado	1.2	1.6	0.5	3.3	1.5	11.2	5.6	18.3	1.5	36.0	11.0	48.5	1.2	1.2	0.5	2.9
Idaho	1.8	1.8	2.3	5.9	4.5	7.5	8.8	20.8	5.5	9.5	12.3	27.3	1.8	1.8	2.3	5.9
Montana	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Nebraska	1.8	1.6	0.6	4.0	2.4	20.0	11.4	33.8	2.4	29.6	31.0	63.0	1.6	1.6	0.6	3.8
North Dakota	1.0	1.0	2.3	4.3	1.5	4.0	11.5	17.0	1.5	5.5	16.5	23.5	1.0	1.0	2.3	4.3
Oregon	2.0	1.0	0.7	3.7	2.3	6.0	2.7	11.0	2.5	7.3	10.3	20.1	2.0	0.8	0.7	3.5
South Dakota	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Utah	3.6	1.9	1.6	7.1	3.0	7.7	11.3	22.0	3.7	10.3	17.7	31.7	2.8	1.8	1.3	5.9
Washington	1.5	2.0	2.3	5.8	2.1	11.7	7.0	20.8	2.1	16.0	9.8	27.9	1.5	1.4	1.4	4.3
Wyoming	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
WEST	1.5	2.6	1.9	6.0	2.2	19.0	23.0	44.2	2.3	25.0	37.5	64.8	1.5	1.5	1.8	4.8
TOTAL U.S.	1.6	1.7	1.5	4.8	2.2	14.5	14.4	31.1	2.3	25.0	23.0	50.3	1.5	1.3	1.3	4.1

* Where no data are given for a state the sample was too small to be meaningful. However, returns from those states are included in the averages for regions and in the total for the U. S.

ed only by a few booming industries such as petrochemicals. Also, the year 1956, itself, saw the founding of an enormous number of new firms. The number of firms organized in 1956 was greater than in any of the other five years since 1951.

The oldest firm answering this survey was founded "before 1832." The firm is Lockwood Greene Engineers, Inc., of New York. It is quite possible that there are older firms in the country who were not involved in this survey, but Lockwood Greene is the oldest one here noted. About 1.3 percent of the firms in the country were organized prior to the turn of the century. It can be said that there are perhaps five times as many firms of consulting engineers in the U. S. less than one year old as there are firms over 50 years old. It is, indeed, a young profession.

The Good Years

Not only did 1956 see more firms formed, but more than half of all the engineers in the country, old or new, agreed that 1956 was their best year. The only year to closely approach it was 1955. Knowing that the rate at which consulting engineer firms are being established is increasing, knowing that the size of the firms is increasing, and knowing that 1956 was the best business year so far, there can be little doubt that even greater growth can be expected in 1957. And the demand for professional services is increasing so rapidly that it is unlikely the supply of consultants will catch up.

While it is possible to say that 1956 was the year during which most consulting engineers were at their maximum, it logically is impossible to assign a particular year to minimum size figures. Such figures would be misleading because they would indicate that there was some particular calendar year during which most consulting engineers were of minimum size. That simply is not so. The fact is that an overwhelming number of firms had their first or second year of business as their minimum regardless of what calendar year it was. Since their first months of

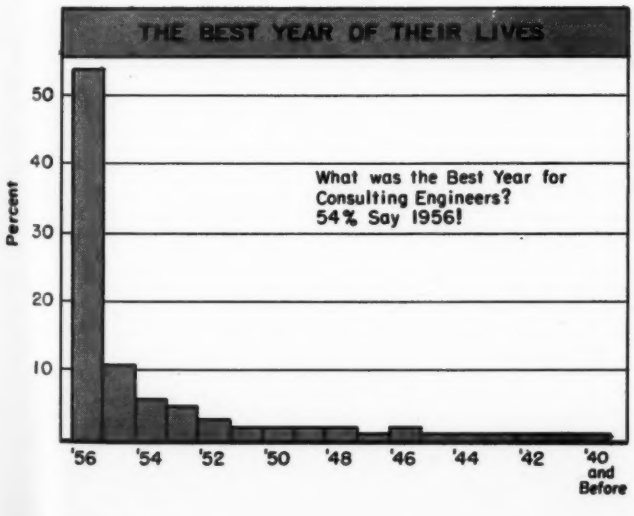


TABLE 2—AGE OF CONSULTING FIRMS

State	Less than 5 years %	5-10 years %	10-20 years %	Over 20 years %
Alabama	20	33	20	27
Arkansas	33	33	17	17
Florida	63	21	4	12
Georgia	47	26	11	16
Kentucky	14	43	29	14
Louisiana	29	43	14	14
Mississippi	—	—	—	—
Missouri	13	46	16	25
North Carolina	29	21	36	14
South Carolina	—	—	—	—
Tennessee	42	33	8	17
Virginia	37	9	18	36
W. Virginia	—	—	—	—
SOUTH	35	31	15	19
Illinois	33	32	10	25
Indiana	34	20	13	33
Iowa	30	20	10	40
Kansas	34	33	33	0
Michigan	37	26	11	26
Minnesota	45	29	10	16
Ohio	35	25	15	25
Wisconsin	45	20	20	15
MIDWEST	38	27	12	23
Arizona	40	30	20	10
New Mexico	50	40	0	10
Nevada	—	—	—	—
Oklahoma	19	44	12	25
Texas	36	35	17	12
SOUTHWEST	35	37	14	14
Connecticut	38	8	31	23
Delaware	—	—	—	—
District of Columbia	20	40	25	15
Maine	—	—	—	—
Maryland	55	0	18	27
Massachusetts	40	27	7	26
New Hampshire	—	—	—	—
New Jersey	45	35	15	5
New York	24	30	20	26
Pennsylvania	37	27	18	18
Rhode Island	—	—	—	—
Vermont	—	—	—	—
EAST	31	27	20	22
California	23	44	15	18
Colorado	45	27	14	14
Idaho	40	40	0	20
Montana	—	—	—	—
Nebraska	20	20	20	40
North Dakota	25	25	25	25
Oregon	33	33	34	0
South Dakota	—	—	—	—
Utah	40	40	0	20
Washington	42	17	17	24
Wyoming	—	—	—	—
WEST	30	37	15	18
TOTAL U. S.	33.5	30.5	15.5	20.5

* Where no data are given for a state the sample was too small to be meaningful. However, returns from those states are included in the averages for regions and the U.S. total.

TABLE 3 — TYPE OF OWNERSHIP

Section	First Organized			At Present		
	Sole Ownership %	Partnership %	Corporation %	Sole Ownership %	Partnership %	Corporation %
South	60	33	7	42	37	21
Midwest	65	28	7	52	28	20
Southwest	40	51	9	43	42	15
East	60	30	10	50	33	17
West	59	26	15	50	31	19
Total U. S.	60	30	10	48	32	20

operation, most firms have shown a steady growth up to the present with only an occasional peak somewhere in between representing a particularly large project or series of projects.

Quite a number of the very old firms did show a minimum size during the depression, but it must be remembered that only 20 percent of the firms now in existence in the U.S. were in operation during the depression. About 80 percent are too young to know anything about it.

Firm Structure

There is a great deal of interest currently in the type of ownership best suited to a consulting firm. Corporate structure is forbidden for consulting engineer firms in some states and is restricted in others. Despite this, there is a trend toward corporate structure in all sections of the country. Table 3 shows a breakdown on this. The table shows that at present almost half of the firms are owned by one man, while about a third are partnerships and the remainder are corporations. However, this is quite different from the type of ownership when the firms were first organized. About 60 percent of all the firms operating today were originally under sole ownership, 30 percent were partnership, and only 10 percent were corporations. Note that the percentage of corporations has doubled.

Close inspection of the individual returns shows that there is a very substantial trend from sole ownership or partnership to corporate structure in all states in which this is permitted. One firm in a state in which corporations are not allowed stated that they were an "association." Such an organization permits a large number of individual engineers to operate as one unit.

Many reasons were given for the change from sole ownership or partnership to corporate structures. Some of the expressions are given below:

¶ To permit principals to participate in ownership.

¶ Set up corporation to settle estate on death of partner.

¶ For financial reasons.

¶ In order to get money to expand.

¶ In order to let employees share in the business.

¶ Partnership was unsatisfactory because too many "equals" tried to run the business.

¶ For tax reasons and desire to expand.

¶ To assure continuation of the company in the event of death of the partner.

The Southwest is the only area in which there has been an increase in the percentage of firms owned by one man. There was, of course, some change from partnership to sole ownership in all sections of the country, but outside of the Southwest, the change toward partnerships was the greater. The reasons for going from sole ownership to partnership are generally given as a need to expand or bringing of key men into the firm. The principal reason for the change from partnership to sole ownership is the death of one or more partners, though there are instances in which personal disagreement accounted for the selling out of one partner to the other.

A very high percentage of the ownership of engineering firms in the U.S. is held within the firms themselves. Only 3 percent of the firms in the country indicated that some of their ownership was held by outsiders. On the other hand, about 22 percent of the firms indicated that some of the persons owning a part of the business were non-registered. In most instances, however, this ownership was held by estates of deceased partners or by young engineers not yet registered.

Age of Principals

There are a great many elderly engineers still actively practicing. A considerable number of firms showed one of their partners in his 70's. In fact, 72 seemed to be a particularly popular age. We may imply from this that consulting engineers do not

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TABLE 4 — EMPLOYEE BENEFITS

Section	Paid Vacations %	Profit Sharing Plan for Employees %	Retirement Plan %	Hospitalization %	Life Insurance %	Other Fringe Benefits %
South	87	54	3	40	23	21
Midwest	88	48	7	38	29	24
Southwest	80	39	6	40	27	27
East	90	41	9	36	26	22
West	89	45	3	43	29	28
Total U. S.	88	45	6	38	27	24

retire young. In one firm of five partners, all but one were over 65, and that one was in his late fifties.

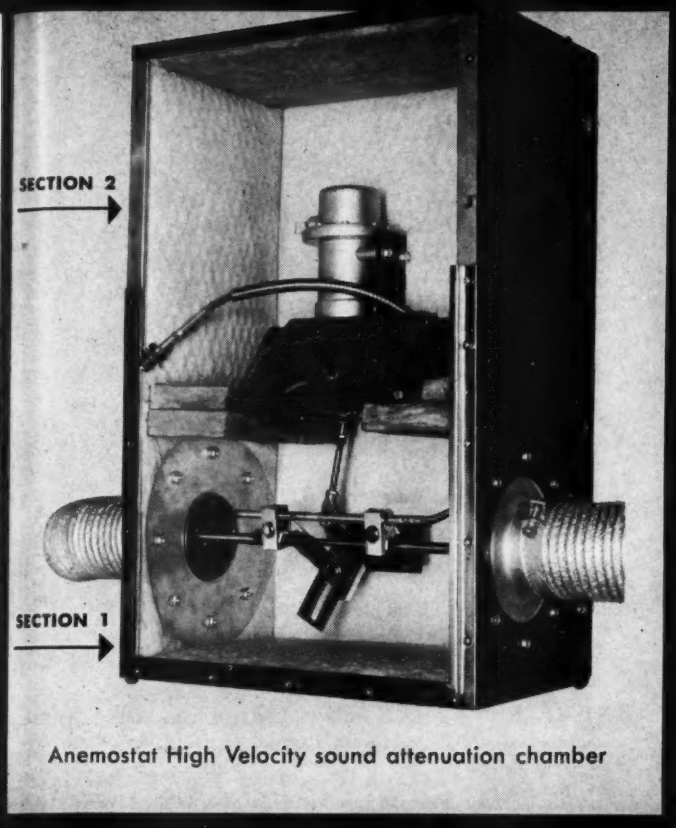
At the other extreme, there are very few consulting engineers who are below 30. A few are in their late 20's, but by far the great majority are between 30 and 60 with the average at 45 years old. A few years ago this average age would have been much older, but many of the new firms established within the past five years have been set up by relatively young men. Business conditions are better today than ever before and more young men can afford to enter private practice, whereas in other years only the financially well established engineer could afford to go on his own.

The last question asked in Part I had to do with fringe benefits for employees. Table 4 shows a breakdown of results. Paid vacations are generally accepted throughout the country, with 88 percent of all firms agreeing that paid vacations are part of the employment picture.

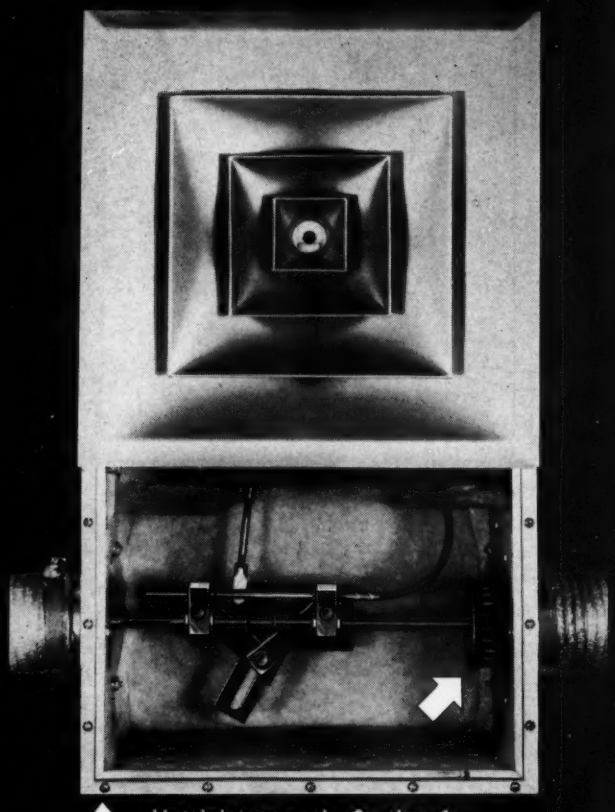
While almost four out of ten firms provide hospitalization for their employees and almost three out of ten have some form of life insurance program, very few firms have any sort of retirement plan. This is due, no doubt, to the fact that most consulting engineer firms are partnerships or under sole ownership, and it is extremely difficult to set up a retirement plan that is tax exempt under any except corporate structure.

If consulting engineers are on the low side so far as other fringe benefits are concerned, they are extremely high when it comes to profit sharing plans. Almost half of the firms have profit sharing plans, and these may be considered to take the place of other fringe benefits. Also, in the column headed "Other Fringe Benefits" most of these are bonus plans, which are a sort of profit sharing arrangement.

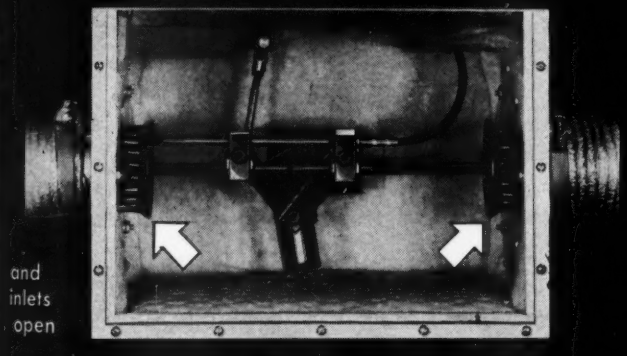
From the tables, charts, and text, it is now possible to get a rather good picture of firm organization among consulting engineers. This analysis of the profession will be continued next month with a report on Parts II-IV of the survey. ▲▲



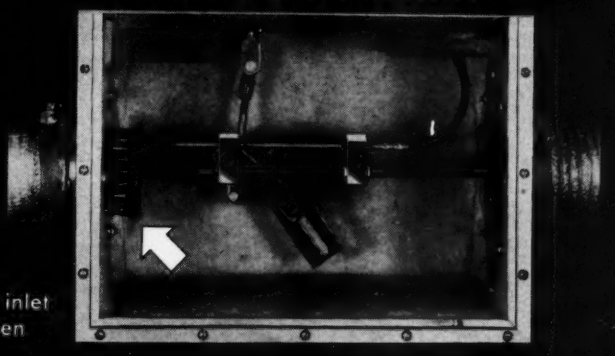
Anemostat High Velocity sound attenuation chamber



Hot inlet open in Section 1.
Anemostat in place covers Section 2



and
inlets
open



Cold inlet
open

How to mix and diffuse high velocity air automatically

The Anemostat High Velocity sound attenuation chamber is divided into two sections. Both hot and cold air from the main risers enter Section 1, which is an acoustically lined blending chamber, in which the volumes of air are controlled by the Anemostat serrated rocket-socket valves. When the thermostat is set, the rocket-socket valves move slowly back and forth, thereby adjusting the volume of air supplied through the hot and cold inlets. The velocity of the air which enters Section 1, at from 3500 to 6000 fpm, is automatically reduced by expansion.

As the blended air meets the temperature requirements of the thermostat, it passes through a baffle arrangement into the acoustically lined Section 2 of the chamber, further reducing the db rating of the air.

The air then passes through the Anemostat Air Diffusers, where the aspiration effect causes mixing of room and supply air within the diffuser, resulting in further temperature equalization. The diffuser then delivers to the occupants of the room draft-free air at the desired temperature.

The Anemostat All-Air High Velocity distribution system offers other important advantages. It can be used with smaller than conventional ducts. It can be installed faster and at less cost. It requires no coils, thus eliminates leakage, clogging and odors. Furthermore, Anemostat round, square and straightline diffusers with high velocity units blend into a wide variety of architectural designs.

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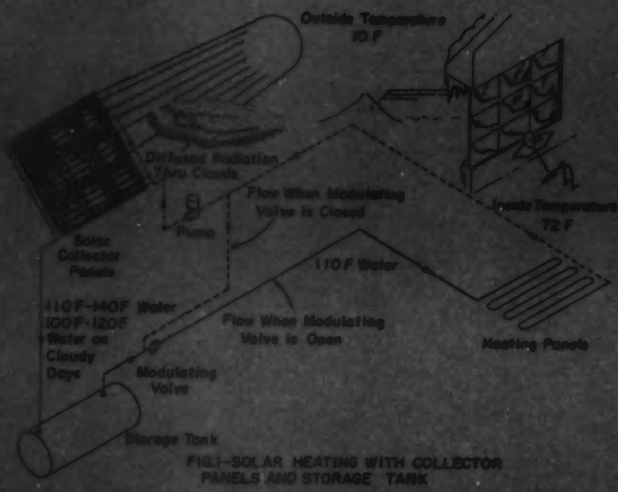


FIG. 1-SOLAR HEATING WITH COLLECTOR PANELS AND STORAGE TANK

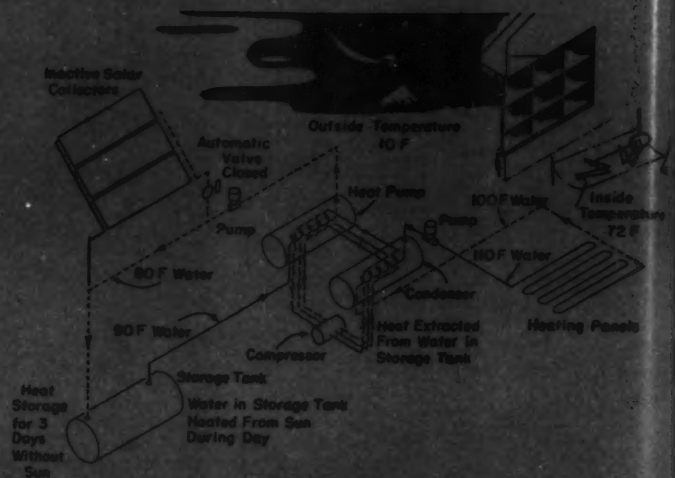


FIG. 2-SOLAR HEATING WITH HEAT PUMP

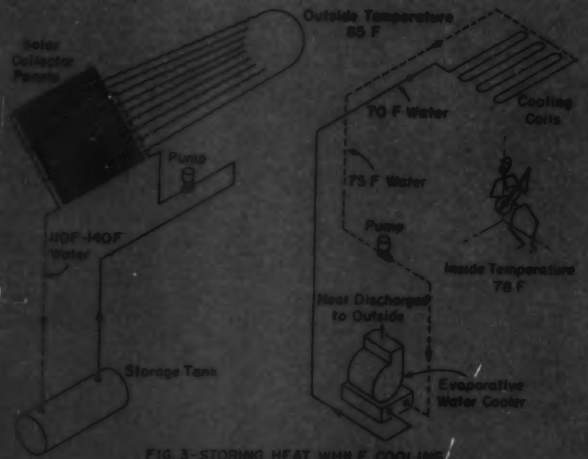


FIG. 3-STORING HEAT WHILE COOLING

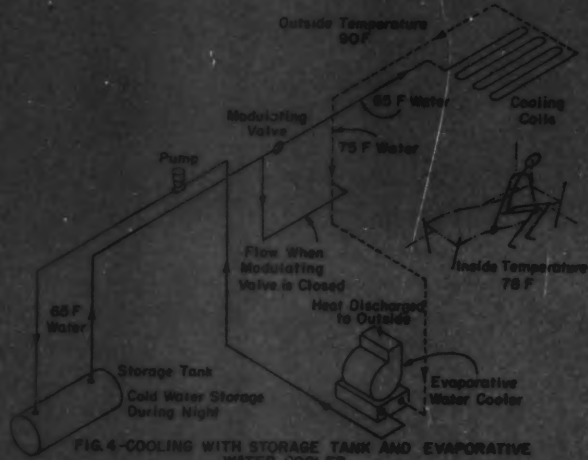


FIG. 4-COOLING WITH STORAGE TANK AND EVAPORATIVE WATER COOLER

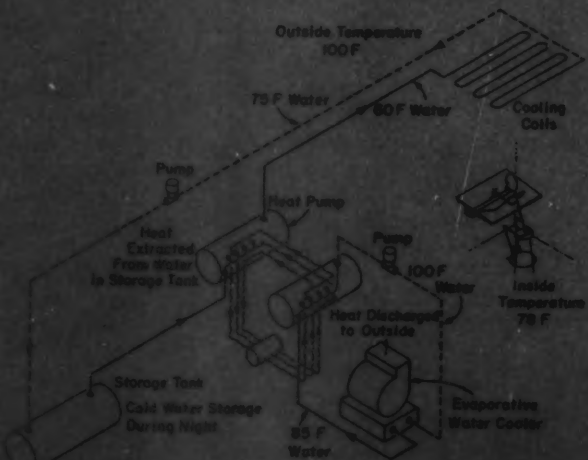


FIG. 5-COOLING WITH HEAT PUMP

BRIDGERS & PAXTON, Consulting Mechanical Engineers, of Albuquerque, N. M., have just moved into a new office building. Naturally, they designed their own heating and air conditioning system, but this particular system represents a radical departure from the usual. It is the first of its kind in the United States. The building is solar heated, heat being collected from plates painted with a special heat absorbing paint and covered with window glass. The whole collector, with a total area of 790 square feet, is tilted at an angle of 30 degrees from the vertical and forms most of the south wall of the building.

The office building has a floor area of 4300 square feet. It was constructed at a total cost of $58,500, or $13.60 per square foot. The mechanical system (plumbing, heating, and air conditioning) cost $17,400, or $4.05 per square foot. This compares favorably with buildings of this type in the Albuquerque area having year-round air conditioning systems.

Heating and Air Conditioning System

The heating and air conditioning system consists principally of the flat plate aluminum solar heat collectors, a 6000-gal underground water storage tank, a 7½-ton refrigerated water chiller, an evaporative water cooler, radiant floor and ceiling panels, a central air handling unit, and auxiliaries such as pumps, valves, piping, and instruments.

The system is arranged so that there are five different water circuits for heating or cooling the building as outside conditions demand. Either of two water circuits is available for cold weather operation. When the sun is bright, water is heated in the collectors, delivered to the storage tank, and then pumped from the storage tank through the heating panels as shown in Fig. 1. A modulating valve is installed between the storage tank and the heating panels so that the inside temperature can be automatically regulated by thermostat. This

Bridgers & Paxton Design Their Own

Solar Heated Office Building

STAFF

circuit will provide an inside temperature of 72 F when outside temperatures are as low as 10 F, providing there is bright sunlight or diffused radiation through clouds.

A second water circuit is used for night operation or extremely low energy periods. This is shown in Fig. 2. Stored heated water is taken from the tank at 90 degrees and put through a heat pump where heat is transferred from the stored water to the water going through the heating panels. The heat of compression of the 7½-ton refrigerated water chiller used as a heat pump also goes into the heating system. The heat added by the compressor is a very small part of the total heat used for heating the building. Most of the heat comes from the solar heated water in the storage tank.

A third arrangement would provide for storing heat while cooling the office area. This is shown in Fig. 3. Solar heat is collected in the plates and pumped into the storage tank. At the same time, with a separate piping system, the water in the room cooling coils is carried through an evaporative water cooler. This would provide 70 F water in the cooling coils with an outside temperature of 85 F, providing a room temperature of 78 F.

When the outside temperature rises to 90 F, the solar collector panels would be closed off from the system and cold water would be stored in the storage tank. This water would be cooled by the evaporative water cooler as shown in Fig. 4.

For extremely high outside temperatures, the 7½-ton refrigerating unit is brought into the cycle as shown in Fig. 5.

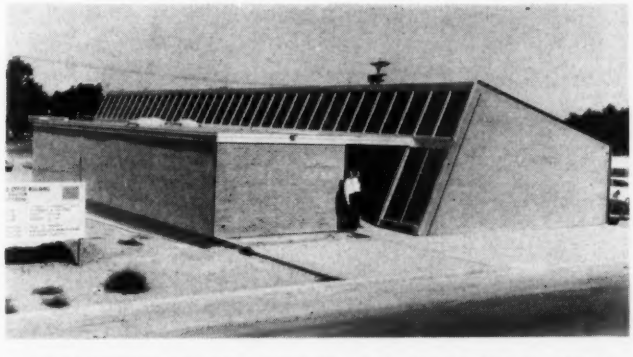
By the use of one of these five water circuits, the indicated inside temperatures can be maintained with outside air temperatures from 10 to 100 F. While both radiant floor and ceiling panels are used in the system, the floor panels are used for heating only, while the ceiling panels and the ventilating air unit are used for both heating and cooling. Automatic valves arranged for manual selection permit the use of any of the systems. However, changeover from heating with collectors only to heating with the collectors plus the heat pump is accomplished automatically under the control of the room thermostat.

The design was based upon recommendations made by Jordan and Threlkeld in their paper "Availability and Utilization of Solar Energy," published in *ASHAE Transactions,* 1954.

Bridgers & Paxton designed the mechanical system while Stanley & Wright, Architects, made the working drawings for the building, itself. Roger Haines, chief engineer of the consulting firm, did the detail calculations, equipment selection, and much of the research.

Since putting the system into operation, a corrosion problem developed due primarily to flux lodging in the water passages which were an intregal part of the aluminum collector plates. Copper tubing was soldered to the plates and used as the water passage. This does not appear to decrease the efficiency of heat collection, and the system is working very satisfactorily at present.

Operating costs of the system will be studied carefully, and results will be published when sufficient data have been accumulated. ▲▲



COLLECTOR PLATES TILTED AT ANGLE OF 30 DEG. MAKE UP ONE SIDE OF THE NEW OFFICE BUILDING.

Report from MEXICO

MARY SAINT ALBANS

CONSULTING ENGINEER CORRESPONDENT

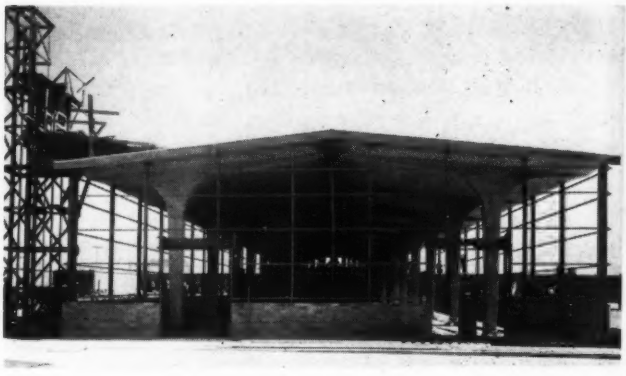
MEXICO'S STEADILY BURGEONING construction projects are demanding more and more engineers of high calibre — and just as in the United States — they are hard to find.

During the last decade money expended in such major enterprises as sugar and petroleum refineries, sulphur, ammonia, electric, and fertilizer plants, and great irrigation and road developments adds up to almost astronomical figures, at least when compared with the previous decades.

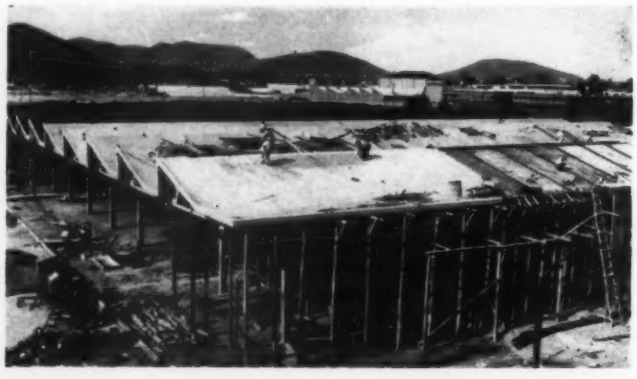
Increased Expenditures

The annual report of the National Financier, S.A., the Federal Government's financing agency, states that 11,611,000,000 pesos ($93 million) were expended by public and private capital in 1955, with a 9,428,000,000 ($75.5 million) figure in 1954. Incidentally, Mexico's production increased 10 percent in 1955 over that of 1954, against 6 percent in the United States, Canada, and Europe; 2 to 4 percent in Asia, and 5 percent in the other Latin American countries.

One reason for this accelerating program is the new U. S. capital coming in to combine with Mexican funds. Lower labor costs, lower taxes, and an expanding Mexican and Latin American market have been a magnetic attraction for U. S. money. The Export Import Bank has facilitated matters through its small loans amounting to $30,776,000 in Mexico last year.



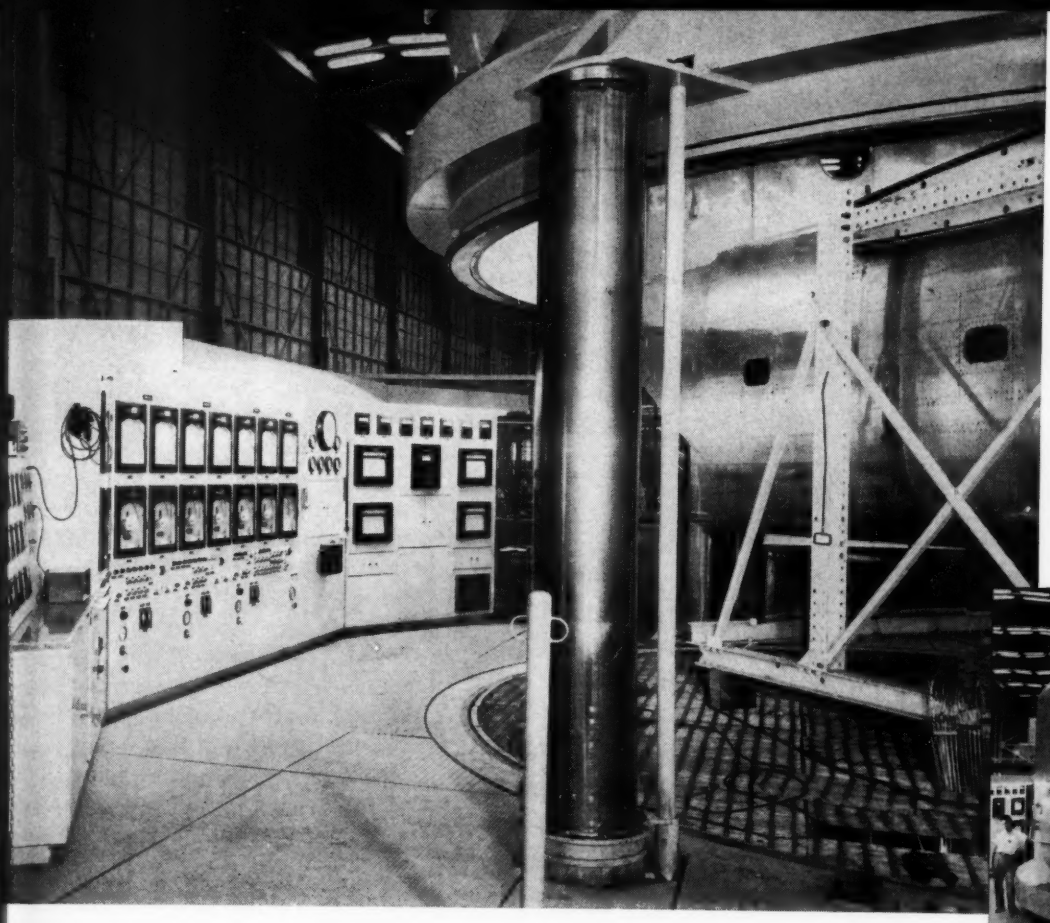
HINGED ARCH DESIGN IS USED FOR THE ROOF OF THIS WAREHOUSE IN MEXICO. THIS IS ALSO A CAMP DESIGN.



UNUSUAL FOLDED PLATE ROOF FOR THIS MATCH PLANT WAS DESIGNED BY CONSULTING ENGINEER G. D. CAMP.

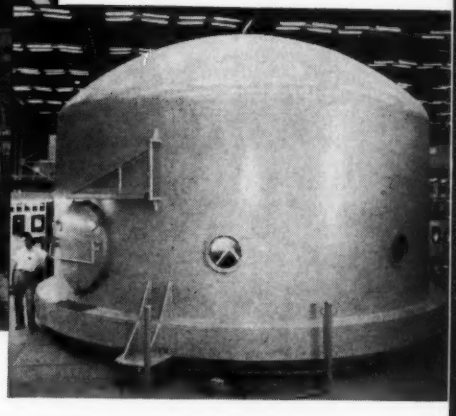
Just as in the United States there is a dearth of engineers here. The Government now is offering to subsidize engineering students. There are few engineers who operate as consulting engineers, according to U. S. and European definitions of the term. Those who restrict their duties to pure consulting — making drawings, writing specifications, and supervising construction — probably could be counted on the fingers of one hand. Most engineering firms in Mexico will, if requested, do straight consulting, but as their organizations are set up for turnkey jobs, they much prefer engineer-constructor work. There are also engineering firms who represent machinery houses. Their main objective is to incorporate their own machinery in the design. The top executive of the local Brown Boveri firm here says that the Electricity Commission is sometimes so beset with work that his company is asked to do an engineering job to help out. "Naturally," he adds, "we make the specifications with our own equipment in mind."

Engineering fees are low in Mexico. Carlos Palo-



From one control panel altitude, ram, or bleed air systems can be controlled manually or automatically. Nearly 200 variables can be measured during a single test run.

This mammoth altitude chamber can accommodate airplane test articles as large as 12 feet high x 18 feet long x 12 feet wide.



F & P CONTROL SYSTEM BRINGS THE STRATOSPHERE DOWN TO EARTH

Flight Conditions Simulated from Sea Level to 120,000 Feet at Douglas Aircraft Company, Inc.

Fischer & Porter instrumentation automatically controls all the essential variables in the operation of the new altitude test chamber at Douglas Aircraft Company, Inc., Tulsa, Oklahoma. Altitude, weather and speed are *automatically controlled* to simulate an airplane's actual flight conditions during take-off, stratospheric cruising, and landing.

All instrumentation is designed so that altitude, ram and bleed air systems can be controlled 3 ways . . . manually, automatically under steady state conditions, or automatically under program control conditions. Altitudes from sea level to 120,000 feet, temperatures from −100°F. to +1000°F. and pressures from 0 psia to 250 psia are easily obtained. During a single test run, nearly 200 measurements of temperature, pressure, flow, humidity, vacuum, and altitude are possible.

Fischer & Porter has successfully furnished package instrumentation on similar aircraft test facilities throughout the country. In your industry F&P's experience in systems engineering, control, field testing, field supervision and field start-up can be of service to you.

Write today for complete information.

FISCHER & PORTER CO. Hatboro, Pa.

COMPLETE PROCESS INSTRUMENTATION

mino, senior engineer of the distinguished firm, Palomino y Mora, S.A., engineers and contractors, states that fees are as low as one dares make them. The average charge for a big turnkey job involving millions of pesos may not run over 3 percent. In the United States 3 percent would seldom cover the consulting fee, with possibly as high as 6 percent added when a firm also handles administrating and contracting duties.

Ingenieria Especializada de Mexico, S.A., believes that fees depend on the amount of technical engineering required, and explains that a warehouse job could not exact the same fee in proportion to money expended as, for instance, a sugarmill. "Engineers frequently calculate their fees on the basis of man-days as well as on the relative value of the men doing the work. A man-day by a senior engineer would result in a higher charge than a man-day of a junior engineer or draftsman. The fee is submitted as a blanket charge without being broken down or itemized," says R. L. Metcalfe, general manager of the firm. "However," he adds, "this method of arriving at a fee is flexible, and may be modified according to the client's wishes."

He agrees with Ing. Palomino that fees are low and cites as one reason, the low draftsmen's salaries. Indeed, in some instances, U. S. firms affiliated with Mexican companies send their drafting jobs here for execution.

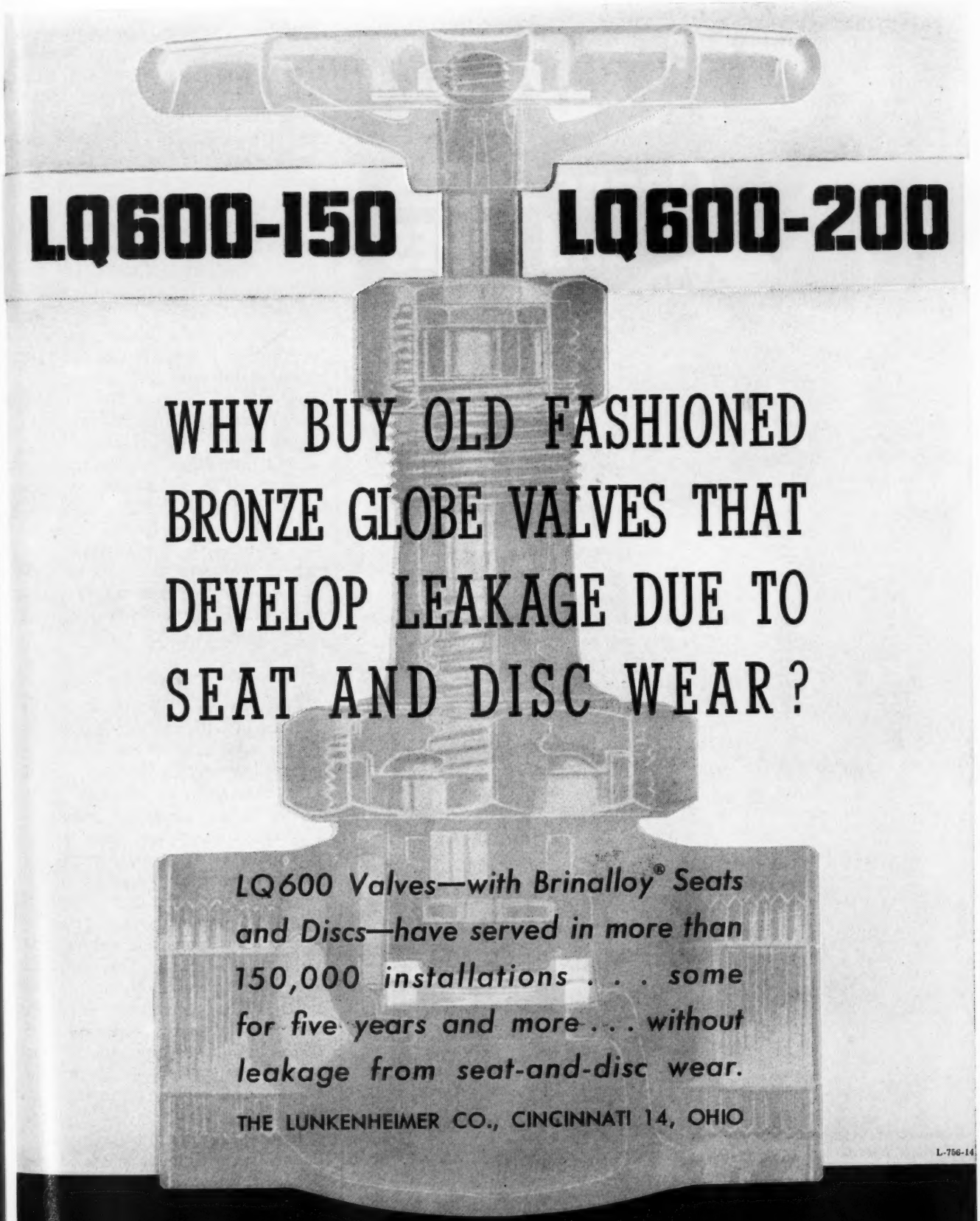
Engineers and engineering firms are registered with the Government. All drawings for new projects or major improvements must be registered and must carry the signature of a registered engineer. A job may involve permits from such Government departments as *Trabajo* (Labor), *Hacienda* (Treasury), *Salubridad* (Health), and *Economia* (Economy).

Engineering Societies

There are two organizations of engineers in Mexico: Association of Engineers and Architects, and the Mexican Association of Mechanical and Electrical Engineers. There is no Consulting Engineers Association, hence no formal code of ethics is drawn up. Consulting engineers, however, invariably belong to one of these two groups.

The Mechanical and Electrical Engineers Association has formed a Commission of Terminology to define and make uniform technical terms used in engineering activities. Now these are a hodgepodge of straight U. S. terms, Mexicanized U. S. terms, Mexicanized European terms, and some devised by the Mexicans to fit their special needs.

It is planned to publish a terminology dictionary, which will be accepted by all Spanish speaking countries. The mastermind behind this enterprise is the local firm of Arthur G. McKee, oil refinery builders, which has done the major installations of Petroleos Mexicanos for over two decades. Recently, both Hudson Engineering and Fluor Corporation entered this field. Hudson erected the Reynosa refinery and the Gulf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WHY BUY OLD FASHIONED BRONZE GLOBE VALVES THAT DEVELOP LEAKAGE DUE TO SEAT AND DISC WEAR?
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Sulphur Corporation plant and is now down in southern Mexico building a duplicate of the Reynosa plant. Fluor erected Mexico's first cracking plant in Minatitlan and has a skeleton organization still there ready to expand, as plans for doubling the plant's capacity materialize.

Brown & Root designed and constructed the America's sulphur plant at Jaltipan, on the Isthmus of Tehauntepec, which is soon scheduled to produce a million tons of sulphur annually.

Another industrial company attracting international attention is Cementos Veracruz, S.A., whose new plant in Orizaba includes many of the most advanced processing methods. The plant makes use of eight dust collector systems, certainly a radical step forward in Mexico. It was built by the company's engineering staff whose senior members have now formed the new consulting engineer firm, Ingenieria Especializada de Mexico, S.A.

Independent Engineer

George D. Camp, a North American who has lived in Mexico for several decades, does only consulting work. Possibly, there are others who restrict their duties to that phase of engineering, but I have not found them. An outstanding authority on Mexico's earthquake and foundation problems (the city is resting on a 97-percent water foundation), Mr. Camp has served not only the Mexican Government, but many private clients of renown. This consulting engineer recently devised a concrete roof of the light truss type with arches three centimeters thick at the center, and eight centimeters at the sides. It was sprayed in place.

In this same match factory Mr. Camp has a light concrete warehouse roof of a hinged design. The object of these innovations is greater flexibility in order to withstand earthquake shocks.

Mexican engineers, incidentally, bear the title Ingeniero. Never is one addressed as Senor which is our equivalent to Mister. Perhaps in this respect we are ahead of the United States in professional development. ▲▲

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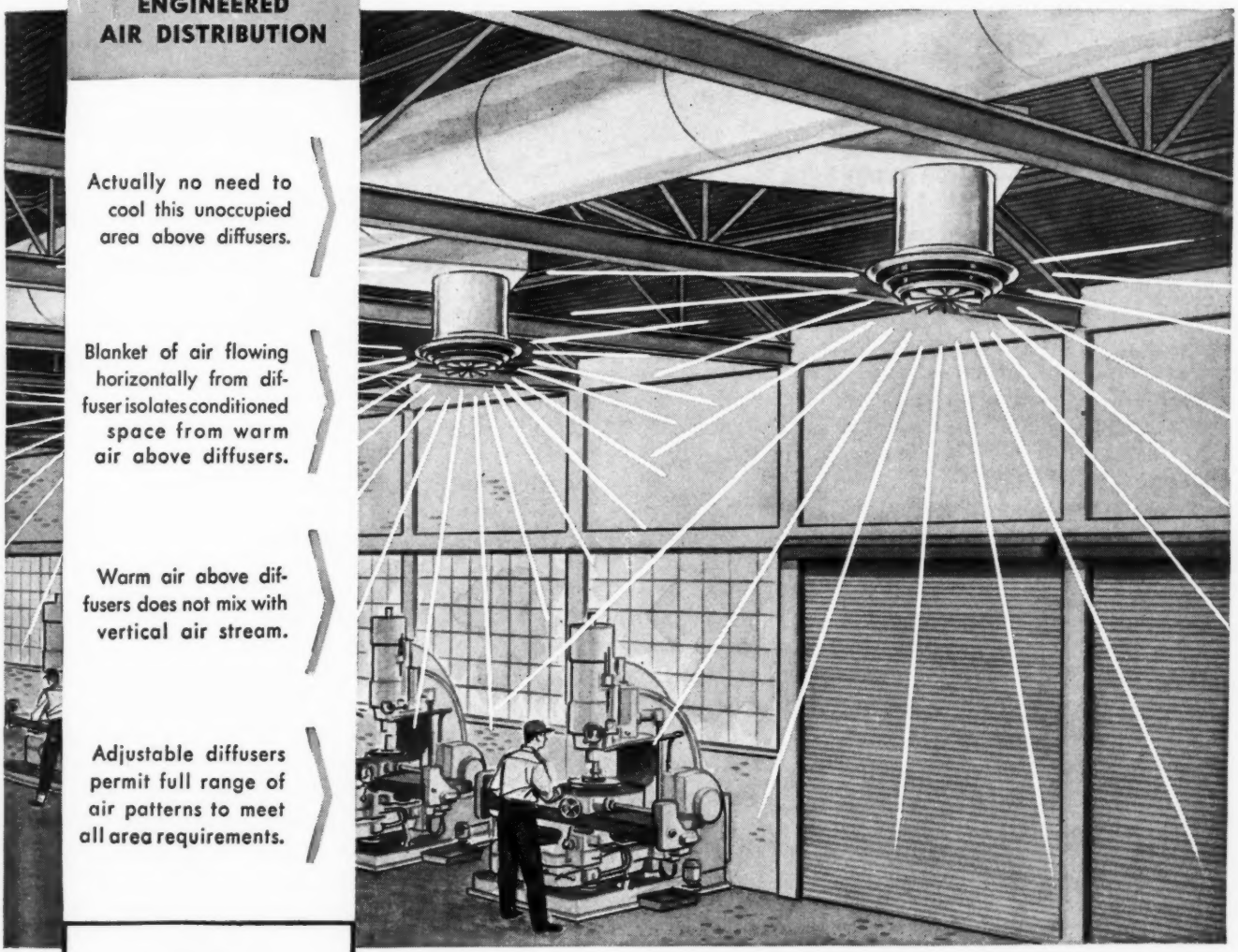
ENGINEERED AIR DISTRIBUTION

Industrial Venturi-Flo Diffuser reduces waste cooling of overhead space



New Model BP Industrial Venturi-Flo Diffuser for high or low ceiling cooling and heating in industrial plants, gymnasiums, auditoriums, hangars, TV studios, etc.

Now you can efficiently deliver spot or area cooling from an unfinished ceiling and virtually ignore the heat load of the large unoccupied space overhead.

Performance of the new Industrial Venturi-Flo Diffuser, as illustrated here, is guaranteed by Barber-Colman Company when diffusers are applied in accordance with published data. Get complete details from your nearby Field Office, or write us today!

Only Barber-Colman Company combines skills in *both* air distribution and automatic controls for *undivided* responsibility.

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News for the Consultant

Oregon Association Plans for Future

The Consulting Engineers Association of Oregon has ratified its constitution and is now under way on a two-year program of development based on recommendations of committees appointed while the group was in the formative stage this summer.

One of the major projects will be a review by the Policy Committee of the various standardized contractual forms presently in use by other consulting engineering groups and development of a standard contract form for use of C.E.A.O. members. Aim is to establish standards of quality setting forth extent of work to be performed as a complete engineering service, as design phase only, as supervision of construction, as professional consultation, and as required for other similar sub-divisions of engineering work, with a schedule of minimum fees for each type of work.

The Practice Committee is working on a code of ethics, which, when completed, will be used to judge ethical practices of state firms. In the public relations field, the P.R. committee has recommended setting up of a joint committee with A.I.A. and the preparation of a booklet explaining what the consulting engineer is, his services, methods of operation, and fees.

The Legislative Committee will work with the Professional Engineers of Oregon to recommend a better registration law to the legislature, and will report to the board of directors any state legislation pending that can affect engineers.

Under the two-year program, C.E.A.O. plans to work closely with the A.I.A. in Oregon on such problems as: relationships of architects and engineers under architectural contracts; relationship under engineering contracts; fee schedules; and practice of both professions in the same firm.

The Board of Directors has also recommended that the Consulting Engineers Association of Oregon become a member of the Consulting Engineers Council.

METAL-CLAD SKYSCRAPER

The new metal-clad 20 Broad Street Building, New York City (left), is in sharp contrast to its neighbor, the New York Stock Exchange. To save construction time and cost, preassembled aluminum sash and spandrel units were end welded to the structural framework before fireproofing concrete was poured. Structural engineer on job was Charles Mayer.

Cities and States Prepare for Increased Water Usage

Of the $2.7 billion of bond issue proposals submitted to the voters in the November general election less than $200 million were rejected. High on the list of public works projects that now have the green light as far as financing is concerned are proposals to increase and improve water supplies and systems. The City of Baltimore voted $45 million for the first part of the work on tapping the Susquehanna River as a new source of supply, and for strengthening the city's water transmission and distribution system.

Baltimore county voters approved $20.5 million for construction of sewer and water facilities. Philadelphia voted $24,780,000 for improvement of the city's water and sewer systems. Wichita, Kan., authorized a $32.5 million issue for purchase of the Wichita Water Company's waterworks distribution system and property.

Other states and cities currently have studies under way by consulting engineering firms for solving water problems.

The state of New Jersey, faced with a serious and growing shortage of water due to increased

population and rapid expansion of industry, has formed a State Water Resources Advisory Committee to help implement a directive by Governor Meyner that a plan of immediate action be prepared for developing both the Round Valley reservoir site property and the water available in the Raritan River.

This citizens' committee is to formulate a plan that will fit into the over-all water resources needs of the entire state, taking into account the studies of the Delaware River currently being conducted by the Army Engineers and the Delaware River Basin Advisory Committee. The committee, headed by George F. Smith, president of Johnson and Johnson, retained the firm of Whitman, Requardt and Associates, of Baltimore, Md., to prepare an engineering survey on which the committee can base its deliberations and conclusions. The group intends to integrate this new study with previously conducted surveys.

Milwaukee, Wis., has set up a research department within the city engineer's office to plan for future expansion of the city's water utility. A waterworks report now being prepared for the city by the firm of Black & Veatch, of Kansas City, Mo., will be used as a basis for the department's expansion studies.

Water Storage Tank Designed For Prestressed Concrete Construction

When the Village of Fridley, Minn., investigated types of water reservoirs with the assistance of Minder Engineering Co., consulting engineers for the village, conventional tank construction was bypassed in favor of a prestressed concrete tank because of its lower initial cost, easier maintenance, and pleasing appearance.

The new 1.5 million gallon water reservoir now under construction, which will provide water storage and pressure for the entire village, was designed by Minder with the cooperation of the Preload Company, Inc., of New York City.

The tank is 70 ft in diameter with a water height of 53 ft. The eight-inch thick walls were poured in four vertical sections or staves. Floor is a reinforced concrete mat four inches thick with a monolithic footing. In order to eliminate base restraint and resultant bending moments in the wall during prestressing operation, walls and dome are floated on 40 rubber pads.

Prestressing was accomplished by the wire winding method developed by Preload. For this method, a "Merry-Go-Around" machine, supported on an overhead carriage on the structure, propels itself around the tank, winding wire in a continuous helix from top to bottom. Initial stress of 140,000 psi is induced in the eight-gage high tensile strength wire by pulling it through a wire die. A loss of 35,000 psi is assumed because of shrinkage and plastic flow of the concrete and relaxation of the wire. The tank was designed on the basis of 105,000 psi permanent stress

in the wire. The dome of the reservoir, a 2¼ in. thick pneumatically-applied-mortar constant radius span, is placed in compression and made self supporting by three miles of wire under tension applied to the dome ring. Walls of the tank are wrapped with an additional eight miles of wire and the entire structure coated with a ¾ in. cover of pneumatic mortar to protect the wire and create bond to the concrete.

California Amendment Rejected

The proposed state constitutional amendment that would have permitted the state to employ private engineers and architects on a contractural basis on state projects has been rejected by California voters (see Oct. CE, p. 110).

The amendment, authored by State Senator John F. McCarthy, was backed by the engineers and architects in private practice through a Joint Steering Committee. Argument for its passage was that state work could be expedited if outside engineers and architects were called in when the available staff of a state department or agency had more work than it could handle in the allotted time.

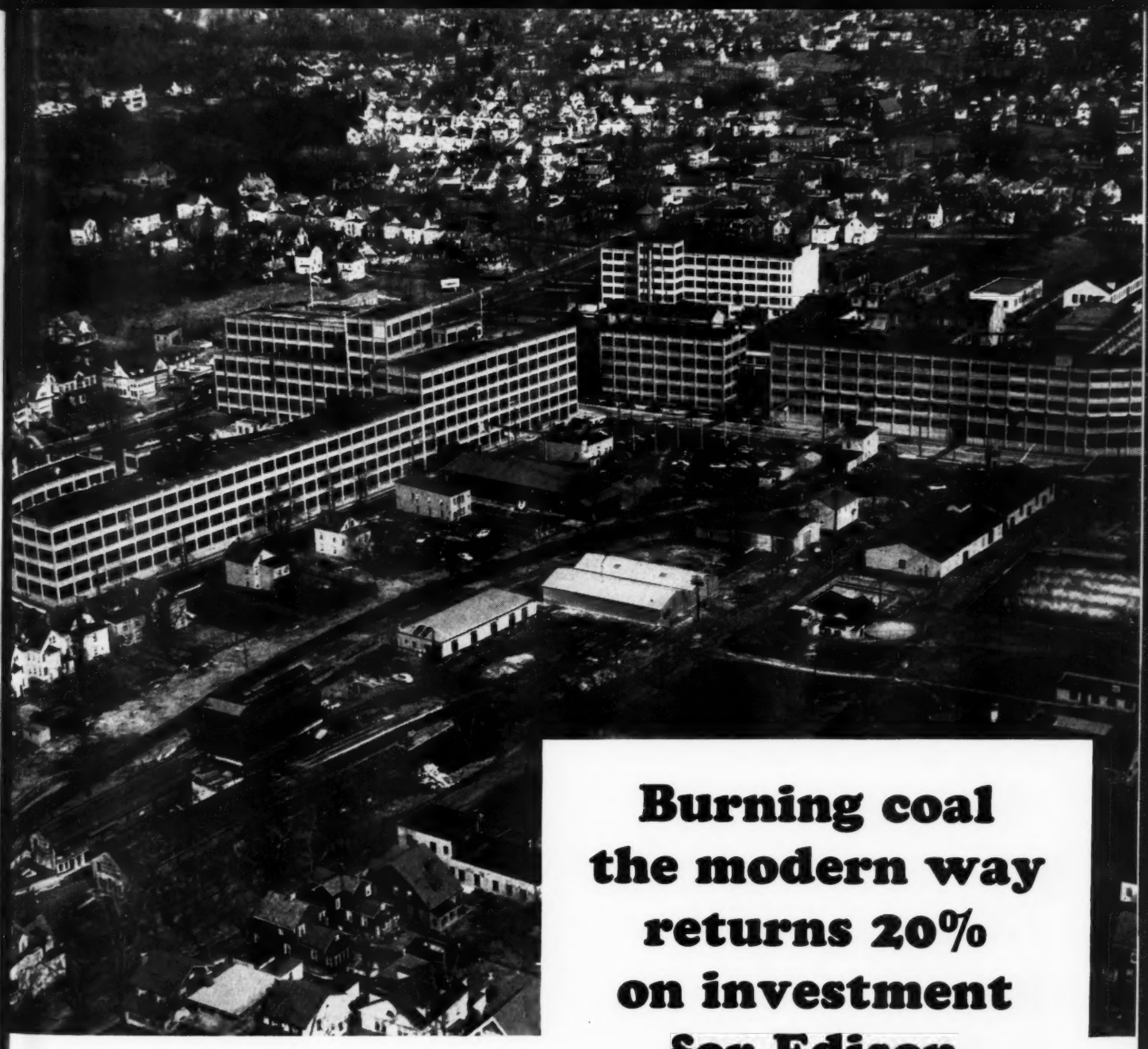
Dallas-Fort Worth Consultants Entertain (and Educate) Press

One of the major projects of every consulting engineer association is the development of good public relations with the press. Recently the Dallas-Fort Worth Chapter of the Texas Association of Consulting Engineers invited members of the local press to a cocktail-buffet party at which each guest

OFFICERS OF DALLAS - FT. WORTH CHAPTER, WITH JOHN KING, CITY EDITOR, DALLAS MORNING NEWS. L. TO R., ARNOLD GAYNOR, GREGERSON AND GAYNOR, SEC'Y-TREAS.; LEO LANDAUER, LANDAUER AND SHAFER, PRES.; MRS. LANDAUER; JOHN KING; ROSS ZUMWALT, ZUMWALT AND VINTHER, FIRST PRES.

was given a press kit of background information on the Chapter, the Texas Association, and the work being done by Texas consulting engineers in all parts of the U. S. and abroad.

It was pointed out that stories about building construction are not complete unless the name of the consulting engineer appears along with the name



Burning coal the modern way returns 20% on investment for Edison

Note to consulting engineers:

Many companies planning a new power plant, or the remodeling of a present one, consult an engineering firm on its design and construction. When you have such a project, our Engineering Department will be glad to assist you in your fuel cost survey with any coal information you may require. In most cases, for the reasons listed below, the use of coal results in substantial savings in increased efficiency and fuel economy through the years.

facts you should know about coal

In most industrial areas, bituminous coal is the lowest-cost fuel available • Up-to-date coal burning equipment can give you 10% to 40% more steam per dollar • Automatic coal and ash handling systems can cut your labor cost to a minimum. Coal is the safest fuel to store and use • No smoke or dust problems when coal is burned with modern equipment • Between America's vast coal reserves and mechanized coal production methods, you can count on coal being plentiful and its price remaining stable.

The firm of Thomas A. Edison, Inc., West Orange, N. J., was faced with a common problem—rising steam plant costs. A thorough survey indicated the need for modernization of the power system. As a result, six 30-year old boilers were replaced with two 60,000 lb./hr. units. FD and ID fans, pneumatic ash systems, coal pulverizers and related equipment were installed.

Modernization has paid off at Edison! Steam-generating capacity per sq. ft. of boiler room space has been doubled, labor costs have been cut, fuel costs are down, boiler efficiency is up 16% and modernization gives a 20% annual return on a net investment of 2.7 mils per BTU!

For further information or additional case histories showing how other plants have saved money burning coal, write to the address below.

BITUMINOUS COAL INSTITUTE
Southern Building • Washington 5, D. C.

of the architect and contractor. Twenty-five years ago there were only two or three consulting firms operating in the Southwest. In 1956 the 13 member firms that form the Dallas-Fort Worth Chapter were responsible for the design and installation of air conditioning, heating, mechanical, and electrical systems in billions of dollars worth of buildings. With this information the Chapter supplied a list of building projects in the Dallas area now under construction or on the boards, listing the consulting engineering firm and the architect.

Network Analyzer Available for Power System Studies

I-T-E Circuit Breaker Co. has available for the use of consulting engineers a network analyzer installation for power system studies. The analyzer is capable of simulating any electrical system that may be represented by up to 12 generators, 88 lines, 32 loads, 16 transformers, and 150 buses. The nominal per diem rental fee includes the services of an operator and an assistant. Location of the installation is in downtown Philadelphia.

For further information, contact the nearest I-T-E district office or the company directly at 19th and Hamilton Streets, Philadelphia 30, Pa.

Centralized Laboratory Facilities Speed Materials Testing for Turnpike

The testing laboratory of the Florida State Turnpike Authority is estimated to have saved more than $250,000 in construction costs on the Miami to Ft. Pierce section of the Sunshine State Parkway.

Soils along the right-of-way were tested to determine if their compactability was suitable for embankments or if they had to be replaced. Section engineers made similar tests in the field. Good cohesive earth having a minimum supporting value of 75 lb per sq in. was required for the top 12 inches of embankment. Limerock for the eight-inch base was tested from quarry stock pile samples.

All asphalt material was double tested for viscosity, first from samples collected at the producers' storage tanks and then from samples taken at the job site. Sand and rock mixed with asphalt were required to be of a certain size to insure correct composition.

Analyses were made each time concrete was poured for culverts and bridges. Tests were run on cement, sand, rock, and water of the suppliers before the concrete was made. In addition, finished concrete samples were put through pressure, acid, and water tests.

Examinations were made on reinforcing steel and prestressing cables for concrete units and on structural steel for bridges. The same was true for bridge and guard rail paints, concrete and corrugated metal drainage pipe, right-of-way fencing, guard rails, timber preservatives for fender bumpers under

One of America's largest and leading dairy associations uses

69 CLEAVER-BROOKS BOILERS

SEE OUR EXHIBIT
BOOTH NOS. 648-650
INTERNATIONAL HEATING & AIR CONDITIONING EXPOSITION
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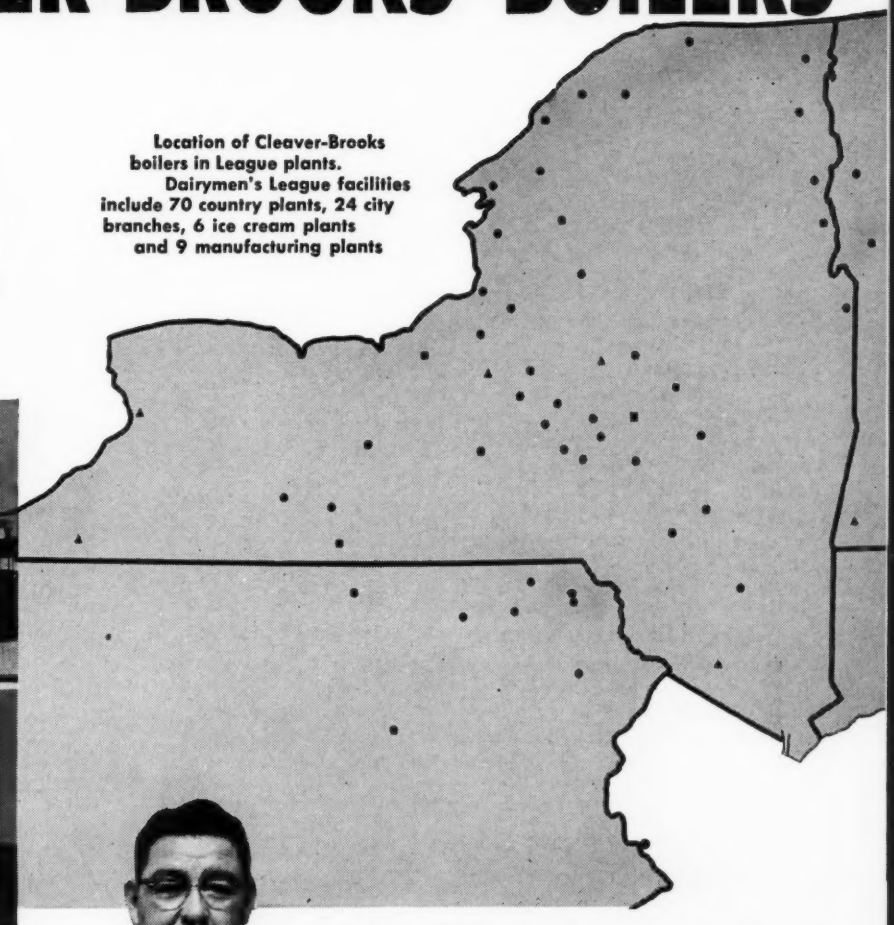
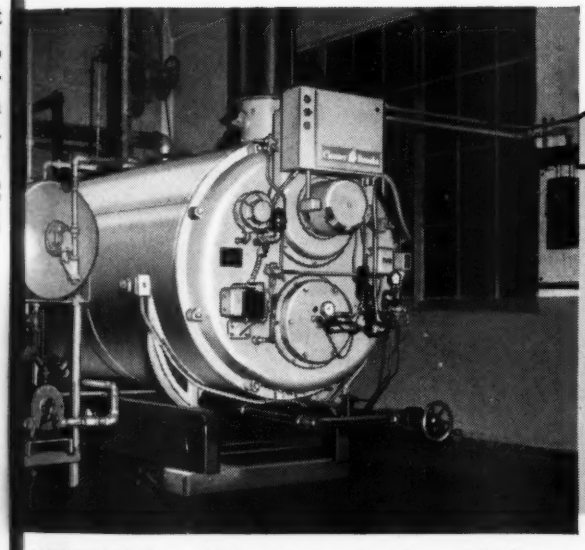


Location of Cleaver-Brooks boilers in League plants. Dairymen's League facilities include 70 country plants, 24 city branches, 6 ice cream plants and 9 manufacturing plants



MILTON, PA. — This country plant is supplied with quick, dry steam from a Cleaver-Brooks 60 hp light-oil fired CB boiler.

"Our 69 Cleaver-Brooks boilers are a key part of our production — their unusually high efficiency, sanitary, clean operation have helped us grow and prosper", says Ken Dodge, staff engineer for Dairymen's League Cooperative Association.

"Maintenance is low. We average far less than one service call per boiler per year," he adds.

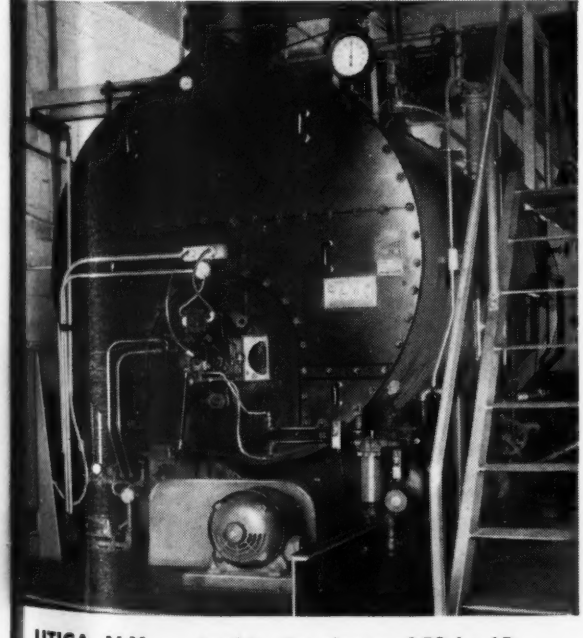
Dairymen's League Cooperative Association, serving 25,000 dairy farmers and thousands of consumers in New York, Pennsylvania and New Jersey, has been a steady user of Cleaver-Brooks boilers for 20 years.

Like any dairy company, the League finds steam essential for the production of quality dairy products. Their boilers are the work horses of their plants — supplying steam for pasteurizing, heating, cleaning and processing.

And Cleaver-Brooks boilers, with their exclusive four-pass, forced draft design and clean, quiet operation are especially suited to dairy plant operation.

Famous dairies the country over are profiting with the many advantages of Cleaver-Brooks boilers, available in a complete line. You can select from 110 models in 18 boiler sizes, 15 through 600 hp . . . oil, gas and combination oil and gas fired.

For more information contact your nearby Cleaver-Brooks representative. Or write Cleaver-Brooks Company, Dept. A, 321 E. Keefe Avenue, Milwaukee 12, Wis. Cable Address: CLEBRO — Milwaukee — all codes.



UTICA, N.Y. — In this city plant a 250 hp LR heavy-oil fired boiler provides all steam for pasteurizing, cleaning, heating and processing.

Cleaver Brooks

ORIGINATORS OF THE SELF-CONTAINED BOILER

timber preservatives for fender bumpers under bridges, and metal posts for turnpike signs.

Eleven full-time employees and three on a part-time basis conducted the tests.

First Certificates Awarded By Intersociety Board

The American Sanitary Engineering Intersociety Board awarded its first certificates at the annual meeting in November. Certificate No. 1 went to Earnest Boyce, professor of sanitary engineering, University of Michigan, and first chairman of the Intersociety Board.

The Board was organized to elevate the standards and advance the cause of sanitary engineering. Requirements for certification are a good moral character and a high ethical and professional standing, graduation from a recognized college of engineering, professional registration, at least eight years' experience, and satisfactory completion of written and oral examinations. Until July 1, 1957, engineers with 15 years of experience may be certified without examination.

About three quarters of the more than 200 applications processed by the Board at its first annual meeting were approved for certification without examination. Ten percent were rejected or held for further investigation and the balance were held for

the first written examination which will be given in 1957. Each applicant will be certified in one of five areas of special qualification: water supply and waste water disposal, public health engineering, industrial hygiene, radiation hygiene and hazard control, or air pollution control.

Officers elected for the 1956-57 year are: chairman, Thomas R. Camp, of Camp, Dresser and McKee, Boston, Mass.; vice chairman, Ray E. Lawrence, of Black & Veatch, Kansas City, Mo.; treasurer, R. S. Rankin, of Dorr-Oliver Co., Stamford, Conn.; and secretary, Francis B. Elder, American Public Health Association.

Eastlake's #4 Generator Uses Liquid Cooling

The electrical industry's first large steam turbine-generator unit using liquid-cooled hollow stator conductors has been installed at the Cleveland Electric Illuminating Company's Eastlake, Ohio, power plant. By cooling the generator stator's conductor bars with a liquid, this type of generator is capable of a 75 percent increase in kva output over a conventionally cooled unit of a similar physical size.

A generator of this type, having a rating of 260,000 kva as does the Eastlake generator, would have essentially the same dimensions as a conventional 150,000 kva generator cooled with hydrogen gas.

According to General Electric engineers, use of a liquid coolant in the hollow conductor bars allows the bars to carry three times more current than present day stators, because the heat generated by the flow of electricity through the copper bars can be carried off more effectively.

Conductor cooling of rotors with a gas and stators with either a gas or a liquid for large steam turbine-generators is a development begun by General Electric shortly after World War II, and is considered a major step in the progress towards larger electrical capacity without increasing physical dimensions.

GE believes that in a few years conductor cooling of generator stators and rotors, coupled with other engineering developments, will allow a 100 percent increase in kva output without any appreciable increase in generator size.

Eastlake also has the first installation of forced-air-cooled isolated phase bus.

Made of aluminum and manufactured by General Electric, it is rated 10,900 amp, believed to be the first of that capacity ever built. With forced-air cooling, the new bus requires smaller housing and as a result offers economic and space-saving advantages. The bus duct is 30 in. square.

Air from a blower enters the center phase of the system at a point directly under the generator terminals and travels the entire length of the duct to the main transformer. The air flow is then diverted by means of baffles to outside phases and returns to the starting point, where it passes through a cooler and "makeup air" sections before being re-circulated.

Such a design makes it possible to furnish isolated phase bus ducts up to 12,000 amp without exceeding the present dimensions of 8000 amp ducts.

Hagan Ring Balance Meter integrates data used to compute charges for air conditioning of Gateway Plaza Restaurant at Gateway Center, Pittsburgh

HERE IS A FLOW METER THAT CAN COMPUTE COSTS

Yes, and then some. The Hagan Ring Balance Meter can do the work of a meter, recorder, computer and controller—simultaneously! Basically, it's a simple mechanical device that measures the flow of any gas or liquid, but its applications in industry are almost limitless.

- *For a central air-conditioning plant,* it measures the exact amount of cooling supplied to each customer, at the same time computes how much each is to be billed.
- *For utilities and their customers,* the Hagan Ring Balance Meter measures the volume of flowing gases or steam or water. It makes accounting easier for both supplier and user, because it measures and records accurately. Its records can be used directly for billing.
- *In a large chemical plant,* it measures varying amounts of both water and alcohol in a flowing, mixed solution, and records the quantity of pure alcohol.

The Hagan Ring Balance Meter is so versatile that it can record up to four measurements simultaneously; measure specific gravity or density; automatically correct for temperature or pressure changes; integrate multiple flow data; and activate controls automatically.

This rugged yet sensitive instrument is typical of the advanced aids to industry which Hagan provides . . . in such varied fields as combustion and process control, force measurement, and industrial water conditioning.

Write for detailed information on Hagan Ring Balance Meters, included in our brochure of products and services. Ask for Bulletin GSP-901.

HAGAN

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Subsidiaries: Calgon, Inc. • Hall Laboratories, Inc.

MEN IN ENGINEERING

James A. Lindsey, Jr., president of Lindsey Engineering Co., Excelsior, Minn., and Archie N. Carter, manager of the highway contractor's division in the Washington, D.C., national office of the Associated General Contractors, are establishing the new firm of Lindsey, Carter & Associates, Inc., Consulting Engineers and Land Surveyors. Headquarters will be at the Tonka Terrace Shopping Center, Excelsior. The firm will specialize in the planning and design of highways, drainage, water supply, sewerage, and other municipal facilities, plus land surveying.

Welton Becket and Associates, architects and engineers, Los Angeles, Calif., has organized a new department of public relations within the firm. Jack Whitehouse will act as director of the department.

Comfort A. Adams, oldest living past president of the American Institute of Electrical Engineers, has been awarded the 1956 Edison Medal. The citation reads "for pioneering achievements in the development of alternating current electric machines and in electrical welding; for vision and initiative in the formation of an engineering standards organization; and for eminence as an educator and consulting engineer."

Ray B. Wheeler has been appointed chief designer of Van Dyck Associates, Westport, Conn. Wheeler recently returned from Haifa, Israel, where he was director of the Israel Product Design Office established by the U.S. International Cooperation Administration and the Government of Israel to provide industrial design services to Israeli manufacturers.

Glenn A. Baker has joined the firm of Archie W. Brown, Consulting Engineer, of Phoenix, Ariz. Baker was formerly industrial power engineer with the Salt River Power District.

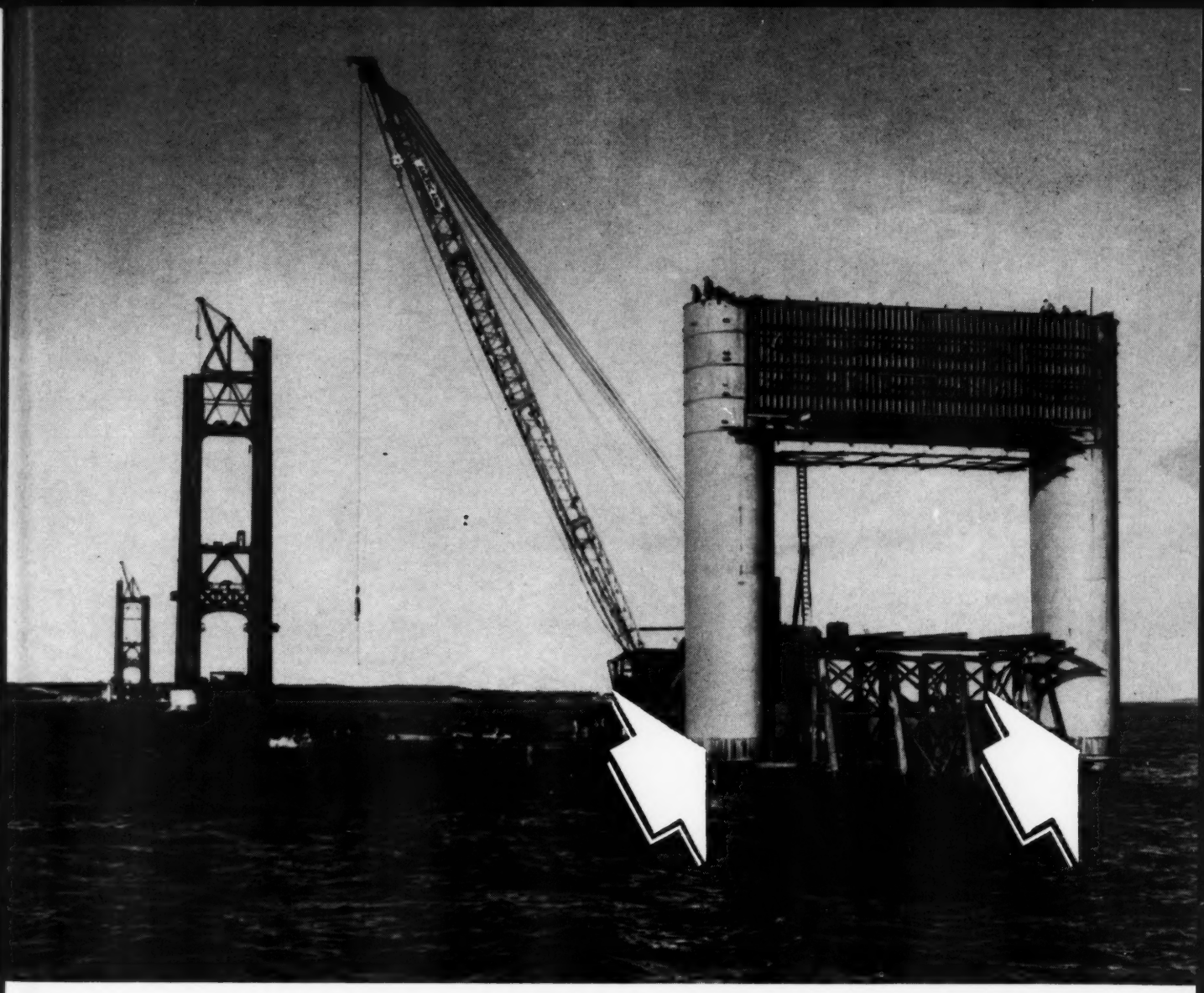
Raymond E. Layton, Consulting Civil Engineer, has changed the name of his firm to R. E. Layton & Associates, Consulting Engineers. The firm recently moved to its new office building at 655 West Avenue 135th, San Leandro, Calif. They designed and supervised construction of the building themselves.

Dr. William C. Alsmeyer has joined the staff of the Leo A. Daly Company, of Omaha, Nebr., as structural consultant. Dr. Alsmeyer was associate professor of civil engineering at Iowa State College.

At the Asphalt Institute, Albert L. Love, Jr., has taken over the post of district manager for New Mexico. Charles A. McKeogh is new district engineer for the Institute at New Orleans. He succeeds William H. Rhodes, who retired recently.

Kenneth Brunner, Civil Engineer, has moved his offices from Los Angeles to 8339 East Second St., Downey, Calif.

Garvin H. Dyer, director of the Missouri Water Co., has been nominated as president of the National Society of Professional Engineers. Of the six regional vice presidents and treasurer nominated only one is a consulting engineer; John B. McGaughy, Norfolk, Va., with the firm of Lublin, McGaughy and Associates. Other nominees are A. H. Kidder, Philadelphia Electric Co.; Harry G. Kennedy, Kanawha Coal Operators' Association; W. L. Hindermann, Asphalt Institute; Clark A. Dunn, Division of Engineering Research, Oklahoma Institute of Technology; L. R. Durkee; Housing and Home Finance Agency, of Seattle; and Russell B. Allen, assistant dean



World's longest suspension bridge stretches four miles across the Straits of Mackinac joining Michigan's upper peninsula with the rest of the state.

Wrought Iron Plates protect Mackinac Bridge pilings against double-trouble

Welded wrought iron plates extending ten feet above and eight feet below the waterline, form a bulwark of protection against corrosion and ice.

Engineers on the $100 million Mackinac Bridge faced this problem: what material could most economically protect the bridge's concrete substructure against recurrent wet-dry corrosion and abrasion by ice?

Consulting Engineer D. B. Steinman, New York, met these requirements by specifying over 270 tons of ⅝-inch wrought iron plates. These plates do double-duty . . . combatting corrosion and guarding pilings against stress and subsequent spalling under dense ice formations.

Wrought iron can cut maintenance costs in your installation, too. Our booklet, "Wrought Iron for Bridge Construction," tells you how and why. Write for a copy.

A. M. Byers Company, Pittsburgh, Pa. Established 1864. Division Offices in Boston, New York, Philadelphia, Washington, Atlanta, Chicago, St. Louis, Houston, San Francisco.

Available in Canada and throughout the world

BYERS *Wrought Iron Tubular and Hot Rolled Products*

ALSO ELECTRIC FURNACE QUALITY STEEL PRODUCTS

of engineering, University of Maryland (nominee for treasurer).

Francis V. Du Pont has become associated as a member of the Board of Directors of Parsons, Brinckerhoff, Hall & Macdonald, Inc., of New York City.

Three consulting engineers will be honored with the grade of Fellow at the annual meeting of the American Society of Heating and Air-Conditioning Engineers: J. Donald Kroeker, principal of J. Donald Kroeker & Associates, Portland, Ore.; Charles S. Leopold, Philadelphia, Pa.; and Samuel R. Lewis, Chicago, Ill.

James R. Libby, former chief engineer of the Freyssinet Company, Inc., and Enis Y. Baskam, former project engineer for Praeger-Kavanah, have established a consulting engineer firm at 151 Radcliff Drive West, East Norwich, N. Y.

New offices of James L. Lindsey, Structural Engineer, are at 415 Pine Avenue Building, Albany, Ga.

Dr. George M. Fekula has been appointed chief process engineer of the Refinery Div., Kaiser Engineers Div. of Henry J. Kaiser Co. He will supervise process engineering of refineries and petrochemical plants.

L. V. Norris, Consulting Engineer, has moved to 1360 Seventh St., Beaumont, Texas.

Walter Kidde Constructors, Inc. has opened a new branch at Baton Rouge, La., to expedite engineering and construction projects in the south and southwest. John H. Jurik will direct the new office.

Gustave D. Cederholm has joined the staff of the Ballinger-Meserole Co. to head the firm's new Prime Distribution Division.

Dr. Augustus B. Kinzel, vice president of Union Carbide and Carbon Corp., has been elected to serve as president of the American Institute of Mining, Metallurgical, and Petroleum Engineers for one year beginning February, 1958. Grover J. Holt, The Cleveland-Cliffs Iron Co., becomes president in 1957. Vice presidents to take office in 1958 are: Edmund C. Babson, Canadian Div., Union Oil Co. of California; and Roger V. Pierce, consulting mining engineer, of Salt Lake City, Utah.

New address of William A. Gavelek, Engineers, is 20 Woodland Ave., Elgin, Ill.

Theodore Weaver, manager of the Process Development Department of the Fluor Corporation, Ltd., Los Angeles, Calif., has been named winner of the 1956 Junior Award of the American Institute of Chemical Engineers. The Award is given annually to encourage excellence in contributions to the publications of the Institute by its younger members.

New address of Eustis Engineering Co. is 3635 Airline Highway, Metairie, La.

WIDDELL — SCHULZ — WIESE

H. E. Widdell, president of the consulting engineering firm of Arthur G. McKee & Company, Cleveland, Ohio, presents 25-year service pins to Melvin E. Schulz and Harold Wiese.

William E. Sees, Jr., Consulting Engineer, has moved his offices to 4335 N. Front St., Harrisburg, Pa.

Slaughter, Saville & Blackburn, industrial engineering consultants of Richmond, Va., and Brown & Blauvelt, New York City civil engineering firm, have formed the partnership of Blackburn, Brown & Blauvelt, of Richmond, Va.

To give greater recognition to the present management of the Detroit, Mich., architect-engineering firm of Smith, Hinchman and Grylls, Inc., the firm has changed its name to Smith, Hinchman and Grylls Associates, Inc.

Pioneer Service & Engineering Co. announces election of Edward M. Imhoff as treasurer, succeeding the late Raymond E. Linehan. ▲▲

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his assignment:

TO HELP YOU FORGET

Kewanee Boilers are advertised to your clients regularly in national publications.

Helping you avoid, solve and *forget* your clients' heating or power problems is the prime assignment of your Kewanee man. He's trained for it, experienced in it—a qualified boiler specialist with the data you need, the knowledge you value.

And his catalog carries the exact size and type of boiler you need for any requirement from 70,000 btu's for a small home up to 651 h.p. for an industrial plant. Every unit fulfills the nation-wide Kewanee reputation for efficiency, fuel economy, low maintenance and long life . . . backed by 89 years of experience.

Kewanee men serve you from a coast-to-coast network of Kewanee Branch Offices. A telephone call brings the nearest one to work with you. American-Standard, Kewanee Boiler Division, 101 Franklin Street, Kewanee, Illinois.

When boiler room space is limited, this Kewanee M-800 Series is an ideal source for 15 lbs. steam or 30 lbs. water or high pressure steam 125 lbs. and up.

AMERICAN-Standard

KEWANEE BOILER DIVISION

New Projects Reported

By Consulting Engineers—

ALABAMA

Palmer & Baker, Mobile, Ala.
Specifications and bid plans for traveling unloading tower bulk handling plant. $750,000. Client, Alabama State Docks Dept., Mobile, Ala.

ARIZONA

Johannessen & Girand, Phoenix & Tucson, Ariz.
Complete facility . . . Air National Guard, Tucson, Ariz. Project will include: hangar, double-ended, with two-story lean-to's each side and three-story annex ($1,000,000); supply and armament storage warehouse, motor service shop, storage bldg., ordnance facility bldg. ($500,000); aircraft parking apron and hangar access area, motor pool park, private vehicle parking ($350,000); taxiways ($500,000); roads, utilities, and misc. ($500,000). Client, Corps of Engineers, U. S. Army (Los Angeles Dist.).

CALIFORNIA

Austin, Field and Fry, Los Angeles.
Art gallery and library — air conditioned. $500,000. Client, Los Angeles County Art Institute.

George Vernon Russell and Associates, Los Angeles, Calif.
Engineering and architectural design of two 600 ft long assembly bays for manufacturing plant at Puente, Calif. Client, Insley Manufacturing Corp., of Indianapolis.

Golden, Bryant & Jehle, El Centro, Calif.
Sewage treatment plant, El Centro. $600,000. Client, City of El Centro, Calif.

Sewage plant additions, Imperial. $104,000. Client, City of Imperial, Calif.

Shopping center, El Centro. $1,500,000. Client, El Centro Improvement Company, Calif.

Capehart housing project, Seeley, Calif. $4,000,000. Client, Paderewski, Mitchell & Dean, Architects.

John S. Bates and Roy M. Trotter, Berkeley, Calif.
Additions to sewage treatment plant. Plans and specifications for clarifier, digester, and oxidation pond. $230,000. Client, Arcata, Calif.

Master plan for development of disposal system. Client, Chico, Calif.

Master plan for the sewage treatment plant and disposal system. Client, City of Chico, Calif.

Byrl D. Phelps, San Diego, Calif.
Sorrento Industrial Center, San Diego, Calif. Installation of 3 mi of sanitary sewer ($25,000); drainage channel ($30,000); 4 mi of roads ($100,000); sewage disposal plant ($50,000); grading of sites for 400 acres of land for industrial purposes ($100,000); and spur railroad tracks ($50,000). Client, Mrs. O. C. Helming, Jr., LaJolla, Calif.

Albert A. Webb Assoc., Riverside, Calif.
Design and construction of Riverside municipal airport. $250,000. Client, Riverside, Calif.

Water treatment plant and primary distribution system. $1,500,000. Client, Elsinore, Calif.

Harvey A. Mylander & Assoc., South Pasadena, Calif.
High pressure pipeline to deliver metropolitan aqueduct water to a part of Maywood, Calif. $56,000. Client, Maywood Mutual Water Companies 2 and 3.

Maurseth & Howe, Los Angeles, Calif.
Underground water well system. Geological and electrical resistivity. Survey for developing supply. Client, U. S. Naval Ammunition Depot, Fallbrook.

Power substation and transmission lines near Puente, Calif. Foundation and geological investigation. Client, Southern California Edison Co.

Seven million gal municipal underground reservoir. Client, City of Santa Ana, Calif.

Research investigation on reservoir lining design. Client, East Bay Municipal Utility Dist., Oakland, Calif.

Walter A. and Walter D. Buehler, Sacramento, Calif.
Addition of 65,000 sq ft to Joaquin Miller Junior High School in Sacramento. Two units have block walls, steel framed roof wood deck; three units have tilt up concrete walls, steel rod frames, wood roof decks. $800,000. Client, Barovetto & Thomas, Architects.

New American River Junior College, drilled pier foundations, walls of tilt up concrete, brick veneer on wood, and grouted brick. Steel framed roof construction, roofs of wood and gypsum. $5,500,000. Client, Barovetto & Thomas, Architects.

John P. Johnston & Assoc., El Segundo.
Electrical and mechanical design for 180-room roadside hotel with approximately 20,000 sq ft. Activities building and 200,000 gal swimming pool including 300 ton reverse cycle, refrigerated cooling and heating system. $300,000. Client, Bakersfield Hacienda, Inc., Bakersfield, Calif.

Alfred B. Sabin & Associates, San Francisco, Calif.
Tannery survey and plant expansion. Additions to finishing department and equipment design. $50,000 (est.). Client, A. K. Salz Co., Tanners, Santa Cruz.

The Fluor Corp., Ltd., Los Angeles.
Engineering work on two substations: a 66/11 kv substation at Puente, Calif., $425,000; feeder distribution service on existing substation near Norwalk, Calif., $50,000. Client, Southern California Edison Company.

Albert C. Martin and Associates, Los Angeles, Calif.
Office and warehouse building with tilt-up walls and pre-tensioned, prestressed concrete roof panels. $1,000,000. Client, General Electric Company Lamp Div., Los Angeles, Calif.

COLORADO

Murray, Riley and Associates, Inc., Denver, Colo.
Central building, Brigham Young University, Provo, Colo. $1,000,000. Client, Lowell Parrish.

Val Verde Junior High School, Denver School Dist. #1. $2,000,000. Client, White and Overholt.

Weather station, U. S. Corps of Engineers. $2,000,000. Client, J. T. Banner & Associates.

Norman H. Todd, Denver, Colo.
Maryland Casualty Co., Denver, Colo. $100,000. Client, Sam Buager.

Petroluem Products Building, Pueblo, Colo. $150,000. Client, Empire Refinery.

Seifer Pontiac-Cadillac Co., Denver, Colo. $200,000. Client, Davidson Co.

Ripple and Howe, Denver, Colo.
Water treatment plant and distribution mains, Clifton, Colo. $200,000. Client, Clifton Water District.

Hudson sewage treatment plant and sewers. $80,000. Client, Hudson Sanitary District.

CONNECTICUT

Genovese & Shumavon, New York City.
Wethersfield span, Connecticut River. Joint venture, **Barstown, Mulligan & Vollmer.** $8,000,000. Client, Greater Hartford Bridge Authority.

DELAWARE

Daniel Koffler, Structural Engineer, Wilmington, Del.
Three-story reinforced concrete frame with precast concrete block floor slabs.

Clyde equipped barge handles 800 T.P.H. for Ohio's Raymond City Coal

Free digging of 700 to 800 tons per hour . . . that's the average coal handling performance of Raymond City Coal and Transportation Corp.'s Clyde equipped barge derrick.

Coal from West Virginia is shipped by barge to their modern and efficient plant at North Bend, Ohio. Here, it is loaded directly into a barge mounted hopper, then by conveyor belt to stock piles, railroad cars or to storage bins for truck loading.

CLYDE EQUIPPED ALL THE WAY

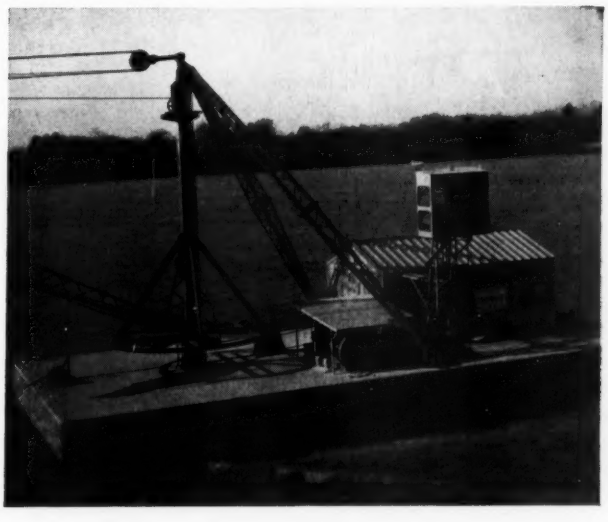
Clyde builds a "working team" for every kind of material handling operation.

Raymond City Coal and Transportation Corp.'s coal handling barge is equipped with a heavy duty, Clyde steel derrick operated by powerful 25,000 lb. line pull hoist and independent swinger.

Two Clyde barge movers position the coal barges during unloading operations. Two Clyde capstans, one at each end of the barge, are used for mooring lines.

Greater capacity, lower handling costs and an operation ". . . free from trouble since its installation . . ." expresses Raymond City's approval of this fast working, Clyde unit.

Your material handling methods can also be improved by using Clyde equipment. *Why not get all the facts on Clyde.*



Air operated Clyde hoist has control lever bank elevated to permit unobstructed vision for operator, Anti-friction bearings on drums and shafts of hoisting equipment and on derrick sheaves, assure efficient and dependable service with less maintenance.

HOISTS · DERRICKS · WHIRLEYS · BUILDERS TOWERS · CAR PULLERS · UNLOADERS · ROLLERS

CLYDE IRON WORKS, INC.
Established in 1899
DULUTH 1, MINNESOTA

A SUBSIDIARY OF BARIUM STEEL CORPORATION

Office building for Hetzler Realty Co., Elsmere, Del. $250,000. Client, Howard Greenhouse, Architect, Frank Durham, Associate Designer.

DISTRICT OF COLUMBIA

Andre Merle Associates, Wash., D. C. Epheses Seventh Day Adventist church, gym, and school, Washington, D. C. 100 ton air-conditioning system. Structural engineer, **John Marks.** $500,000. Client, R. C. Archer, Jr., Architect.

Gethsemane Baptist church, gym, and school, Washington, D. C. 300 ton air-conditioning system. Structural engineer, **John Marks.** $1,250,000. Client, R. C. Archer, Jr., Architect.

FLORIDA

Russell & Axon, Daytona Beach, Fla. New streets, street resurfacing, etc. $912,000. Client, City of Ocala, Fla.

Sewage treatment and interceptor sewers. $175,000. Client, City of Venice, Fla.

Sewers, sewage treatment plant, water supply, and treatment and distribution. $6,700,000. Client, City of Lake Worth, Fla.

Water distribution, sewage collection, and disposal. $1,000,000. Client, Town of Pinellas Park, Fla.

Water supply, water strengthening mains, sewers, sewage treatment, garbage and trash disposal. $3,000,000. Client, Belle Glade, Fla.

Sewage treatment and lift stations. $200,000. Client, Naples, Fla.

J. E. Curley & Associates, Miami, Fla. Bunche Park Junior-Senior High School, Dade County, Fla. 50-room, with gymnasium, auditorium, library, kitchen, and cafeteria. Central hot water heating system. Electrical, heating, ventilating, and plumbing. $1,500,000. Client, Pozevitzky, Johnson & Associates, Architects.

DuPont Plaza Architectural & Construction Industry Center, Miami, Fla. 100,000-sq ft Architect's Samples Bureau; 256-room hotel with banquet hall; 80,000-sq ft office building. 1000-ton centrifugal air conditioning; 450 hp, 125 lb steam boilers; 277/480 v electrical system, 2500 kva. $6,000,000. Client, Peterson & Shuflin, Architects.

Springtide Apartments, Ft. Lauderdale, Fla. 71 deluxe apartments (co-operative), swimming pool, snack bar, hot water heating, optional air conditioning. $1,500,000. Client, Pozevitzky, Johnson & Associates, Architects.

Key Colony development, Marathon.

Key Colony Beach Club co-op apartments (40 units); Sands Motel (60 units); Roman Motel (40 units) with Cabana Colony and restaurant. $750,000. Client, Robert Karl Frese, Arch.

GEORGIA

J. Arthur Maddox, Savannah, Ga. Tabernacle Baptist Church. $5000. Client, Tabernacle Baptist Church.

Office building, electrical, Savannah. $5000. Client, Powell Construction Co.

Creston Knitting Mills, electrical system, Swainsboro, Ga. $30,000. Client, Creston Knitting Mills.

IDAHO

Hoffmann, Fiske, Milar, Boise, Idaho. Design of 26 miles of highway between Cambridge and Brownlee Dam, Idaho. $1,000,000. Client, Idaho State Hwy. Sys.

Nampa- South. 7½ miles of urban highway, Idaho. $1,000,000. Client, Idaho State Highway System.

30 miles of forest access roads, Idaho. $1,200,000. Client, U. S. Forest Service.

Meridian sewage disposal plant, Meridian, Idaho. $150,000. Client, City of Meridian.

Ground control for aerial surveys. Client, U. S. Steel, Bureau of Reclamation.

Briggs & Associates, Boise, Idaho. Preliminary investigations, design, and construction supervision for approximately 9 mi of inverted penetration and seal street oiling. $65,000. Client, City of Hailey, Idaho.

Investigation, design, and construction supervision of 175-ft span steel truss bridge across Salmon River, 19 mi south of Salmon City, Idaho. $20,000. Client, Lemhi County, Idaho.

Investigation, design, and construction supervision of 140-ft span steel truss bridge across Weiser River, 3 mi east from Cambridge, Idaho. $16,000. Client, Washington County, Idaho.

Investigation and design for construction of 2.5 mi of Federal secondary highway, 3 mi southwest from Hazelton, Idaho. $65,000. Client, Hillsdale Highway Dist., Hazelton, Idaho.

Investigation, design, and construction supervision of 3.2 mi of sanitary sewers. $60,000. Client, City of Alameda.

ILLINOIS

Dunlap and Esgar, Inc., Chicago, Ill. Design of two modern laboratory buildings, including paving, landscaping, and equipment for Research and Development Laboratories, Skokie, Ill. $2,750,000. Client, Portland Cement Association, Chicago, Ill.

Klefstad Engineering Co., Chicago, Ill. One-story office and manufacturing building, 165,000 sq ft, constructed of brick. Office area and part of shop area air-conditioned. Parking facilities for 300 cars. Size of site 329 x 1260 ft, located in Morton Grove, Ill. $1,800,000. Client, Radiant Mfg. Corp., Subsidiary of U. S. Hoffman Machinery Corp.

Laramore and Douglass, Inc., Chicago. Additional turbine, 2500 kw, water treatment, cooling tower, and auxili-

aries. Elgin State Hospital, Elgin, Ill. Client, State of Illinois, Welfare Dept.

Complete new boiler house, two 225,000 lb boilers, spreader stokers, water treatment, coal and ash handling, and all required auxiliary equipment for Peoria plant. Client, Caterpillar Tractor Co., Peoria, Ill.

IOWA

Shive Engineering Co., Cedar Rapids. New sewerage system, treatment plant, roads, and renovation of water supply system for privately owned peninsula in Lake MacBride Park, Johnson County, Iowa, where water level of lake is being raised 30 ft due to Federal flood control project on Iowa River. $175,000. Client, Cottage Reserve Corp., Lake MacBride Park, Johnson County.

KENTUCKY

Wigton-Abbott Corp., Plainfield, N. J. Plant to manufacture specialty acrylic polymers at Calvert City, Ky. process building, shop, and warehouse. $2,500,000. Client, B. F. Goodrich Chemical Co., Cleveland, Ohio.

MARYLAND

Herbert Manuccia, P.E., and Associates, Washington, D. C.
Holy Family Parish, Hillcrest, Md. Church, school, convent, rectory. Engineering design (structural). $650,000. Client, architect, Frank Duane.

Johnson & Williams, Washington, D. C. Sewage treatment plant and sewage lift station, Leonardtown, Md. $100,000. Client, Leonardtown, Md.

Alexander E. Forrest, Baltimore, Md. Belvedere Ave. Bridge (4 spans) over Jones Falls Expressway. Jointly with Maryland Surveying & Engineering Co. $600,000. Client, City of Baltimore.

Henry Adams, Inc., Baltimore, Md.
University of Maryland Hospital, miscellaneous mechanical and electrical renovations and additions, Baltimore, Md. $300,000. Client, James R. Edmunds, Jr., Architect.

Johns Hopkins Hospital, miscellaneous mechanical and electrical renovations and additions, Baltimore, Md. $500,000. Client, James R. Edmunds, Jr., Arch.

MASSACHUSETTS

Automation Management, Inc., Westboro, Mass.
Labor cost distribution system, Cambridge, Mass. $5000. Client, Carter's Ink.

Duffill Associates, Inc., Boston, Mass. Highway bridge (overpass), Andover, Mass. $500,000. Client, Department of Public Works, Boston, Mass.

MINNESOTA

J. Robert Snyder, Minneapolis, Minn. New high school building for Independent Consolidated School District 240, Anoka County, Minn. $600,000 (est.) Client, Herbert B. Crommett, Architect.

New factory and office building for Streater Industries, Inc., at Albert Lea, Minn. 62,000 sq ft. Client, Streater Industries, Inc., Spring Park, Minn.

Jas. V. Edeskuty & Associates, Minneapolis, Minn.
Austin Municipal Power Plant. 145,000 lb per hr Riley boiler, 900 psig, 900 F.T.T. $650,000. Client, Board of Water, Electric, Gas and Power Commissioners, Austin, Minn.

Baker Properties, Inc. 60,000 lb per hr boiler, heating load 150 psig. $200,000 (est.). Client, Baker Properties, Inc., Minneapolis, Minn.

MISSISSIPPI

The Fluor Corp., Ltd., Los Angeles. Design, engineering, and construction of phosphate fertilizer plant at Pascagoula, Miss. $2,000,000. Client, Coastal Chemical Corp.

MISSOURI

Russell & Axon, St. Louis, Mo.
Water works system, well, elevated tank, and mains. $65,000. Client, City of Berger, Mo.

St. Louis Air Force Reserve Training Center, located in south St. Louis. Plans in progress. Client, Kansas City Dist., Corps of Engineers.

Cape Girardeau, Mo., flood protection, flood wall, pumping stations, etc. Client, St. Louis Dist., Corps of Engineers.

Drazen and Associates, Clayton, Mo. Approx., 300 mi of aerial wire and aerial cable plant, located in Callaway County, Mo. Client, Kingdom Telephone Co., Auxvasse, Mo.

Uri Seiden & Associates, Kansas City. Antioch shopping center, Kansas City, Mo. $5,000,000. Client, Curry Real Estate Co.

Wellsville grade school, pre-cast concrete construction. $300,000. Client, Tewksbury & Assoc., Architects.

Concrete college dormitory, Central Missouri State College, Warrensburg, Mo. $500,000. Client, Everitt & Keleti, Architects.

Altamont school addition, high school building, Altamont, Mo. $450,000. Client, Franckiser & Hutchens, Architects.

Smith & Tao, St. Louis, Mo.
Washington University engineering laboratory, St. Louis, Mo. $700,000. Client, Fitch & Nicholas, Architects.

Larkin & Associates, Kansas City, Mo. Swimming Pool. $80,000. Client, City of Tarkio, Mo.

Swimming pool. $95,000. Client, City of Lamar, Mo.

Swimming pool. $145,000. Client, City of Cape Girardeau, Mo.

Sewage treatment plant. $180.000. Client, City of Marceline, Mo.

MONTANA

Flahart & Colgan, Rapid City, S. D.
26-kv transmission line, 30 mi, Mont. $100,500. Client, Black Hills Power and Light Co.

NEVADA

Burns & McDonnell Engineering Company, Kansas City, Mo.
Engineering and architectural design of new technical area at AEC's Nevada test site. Client, Atomic Energy Commission.

Holmes & Narver, Inc., Los Angeles.
Design and supervision of construction of major test facilities at the AEC's Nevada test site, including towers, bunkers, and instrumentation stations. Client, Atomic Energy Commission.

NEW JERSEY

Louis P. Booz, Perth Amboy, N. J.
600 ton municipal incinerator. $3500. Client, Jersey City Incinerator Auth.

Paul K. Gerhardt, Englewood, N. J.
Truck terminal, North Bergen, N. J. $100,000. Client, Ward Trucking.

Factory building, North Bergen, N. J. $150,000. Client, Outerwear Mfg. Co.

Factory building, Union City, N. J. $50,000. Client, National Velvet.

Catholic church, Newark, N. J. $50,000. Client, Newark Dioscese.

Catholic church, Saddle Brook, N. J. $75,000. Client, Newark Dioscese.

Catholic high school, Wayne Township, N. J. $300,000. Client, Paterson Diocese.

Catholic convent, East Orange, N. J. $100,000. Client, Newark Dioscese.

Catholic rectory, Bronx, N. Y.

R. L. Hoerig, E. Orange, N. J.
Maplewood post office, 112 x 153 ft, one-story, brick and steel. $250,000. Client, U. S. Post Office Dept.

NEW MEXICO

Dr. Marcello Giomi, P. E., Albuquerque, N. M.
High school auditorium and 16-classroom elementary school. Air conditioning and plumbing. Lovington, N. M. $1,000,000. Client, Schaefer, Merrell & Associates, Architects.

High school auditorium with air-conditioning system. Hobbs, N. M. $750,000. Client, Vorhees & Standhardt, Arch.

St. Ann Hospital and convent, air conditioning and plumbing. Truth or Consequences, N. M. $550,000. Client, Burwinkle & Milner, Architects.

Telephone building, air conditioning and plumbing. Las Vegas, N. M. $300,000. Client. Ferguson, Stevens & Associates, Architects.

The Stapp Engineering Co., Denver.
Installation of boilers and turbines, municipal power plant. $300,000. Client, Farmington, N. M.

NEW YORK

David R. Malman, P.E., Bayside, L. I., New York.
Huntington High School, Huntington, L. I., N. Y. Two-story, steel skeleton. Auditorium with balcony, welded steel trusses over auditorium and gym. Gym roof exposed rolling slope with layout for economy. $4,000,000. Client, F. P. Wiedersum, Architects.

New Hyde Park, 2 new elementary schools and 2 additions to elementary schools. $4,000,000. Client, New Hyde Park Board of Education, Union Free School District No. 9, North Hempstead, L. I., N. Y.

Eckerlin & Klepper, Syracuse, N. Y.
Structural design of Herkimer, N. Y., high school. Two-story reinforced concrete school with auditorium, gymnasium. pool, shops. $1,500,000. Client Ketcham, Miller, Arnold, Syracuse, N.Y.

Structural design of New York Mills, N. Y., Central High School. One and two-story, steel and bar joist construction with auditorium and shops. $1,250,000. Client, Myron Jordan, Richfield Springs, N. Y.

William T. Ingram, Whitestone, N. Y.
Trunk sewers, Sanitary District No. 5. $28,000. Client, Town of Greece, Monroe County, N. Y.

Sewage treatment plant, Sanitary Sewer District No. 5. $25,000. Client, Town of Greece, Monroe County, N. Y.

Preparation of tentative engineering plans for extension of trunk sewers in Sanitary Sewer District No. 1. $2,800,000. Client, Town of Greece, Monroe County, N. Y.

Robert Rosenwasser, New York City.
20-story, reinforced concrete apartment building, flat plate construction. New York City. $2,000,000. Client, L. Bregman & Sons, owner, and H. I. Feldman, Architect.

20-story, reinforced concrete apartment building, flat plate construction, New York City. $2,000,000. Client, Stanley R. Broff, owner, and H. I. Feldman, Architect.

3-story and roof reinforced concrete manufacturing plant. 20,000 sq ft per floor, flat plate construction with a 100 ft structural steel tower, 52 x 52 ft sq superimposed roof. Jamaica, L. I. $1,000.000. Client, Sol Cafe Mfg. Co. and Myles Gordon, Architect.

Cuthbert E. Reeves, Buffalo, N. Y.
Revaluation of all real property in the City of Buffalo, for the Board of Assessors, about 100,000 parcels. Client, Board of Assessors, City of Buffalo.

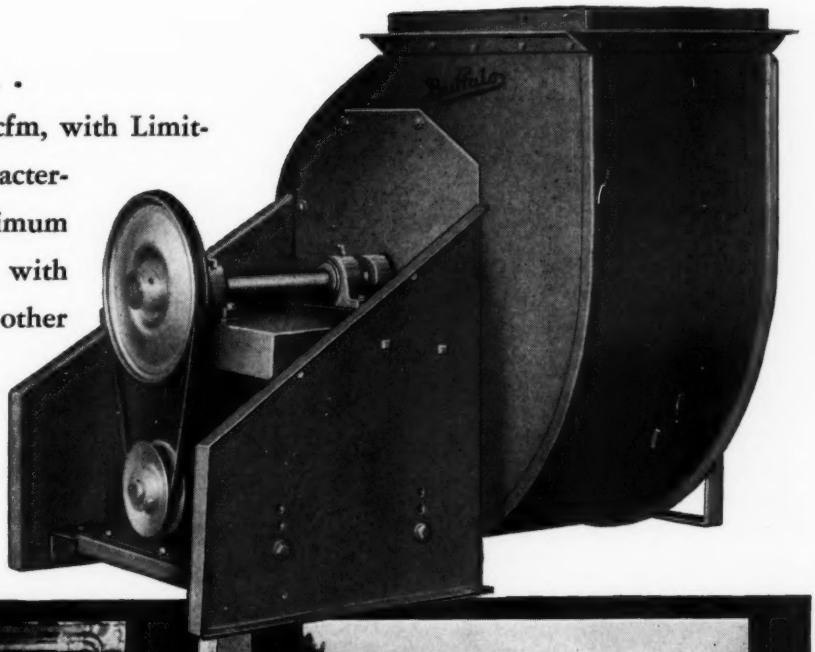
Dorfman-Bloom, Philadelphia, Pa.
12-story concrete apartment building,

VENTILATING FANS

- for easy, "package" installation
- that are lightweight and compact
- that are unusually quiet and efficient
- for indoor or outdoor installation
- with capacity that's adjustable any time

"Buffalo" BELTED VENT SETS . . .

in capacities from 500 to 20,000 cfm, with Limit-Load (R) non-overloading characteristic and inlet guide vanes for minimum noise and turbulence. Available with all-weather drive cover for roof or other outdoor installation. *Write for Bulletin 3720.*



Multiple unit installations like this provide flexibility with economy.

Roof installation with All-Weather Drive Covers.

"Buffalo"

BUFFALO FORGE COMPANY

BUFFALO, NEW YORK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

VENTILATING AIR CLEANING AIR TEMPERING INDUCED DRAFT EXHAUSTING
FORCED DRAFT COOLING HEATING PRESSURE BLOWING

164 units. Rochester, N. Y. $2,000,000. Client, Schwartz, Krumbhaar, Briggs, Architects.

Giffels and Vallet, Detroit, Mich.
Design and engineer laboratory to house development engineering for Kingston Military Products Div., Kingston, N. Y. Client, International Business Machines Corp.

The Ballinger-Meserole Co., Philadelphia, Pa.
Survey possibilities for new food distribution center. Client, P and C Family Foods, Inc., Syracuse, N. Y.

Genovese & Shumavon, New York City.
Blind Brook Bridge-Cross County Parkway, Rye, N. Y. $200,000. Client, Westchester County Public Works Dept.

Greenhut & Taffel, New York City.
New station for N. Y., N. H. & H. Railroad, local and express, New Rochelle, N. Y. Client, New Rochelle Development Corp., New York, N. Y.

Shopping center, New Rochelle, N. Y. 750,000 sq ft, 70 stores, including department store, 5000-car parking under cover, banquet facilities, office building, etc. $30,000,000. Client, New Rochelle Development Corp.

Officers Club, West Point. $250,000. Client, Greenberg & Ames, Architects.

Arsenal, Watervliet, N. Y. $2,000,000. Client, Greenberg & Ames, Architects.

Luxury apartment building, New York City. $4,000,000. Client, Boak & Raad, Architects, New York, N. Y.

Apartment building, New York City. Client, Greenberg & Ames, Architects.

Gennaro Mianulli, Brooklyn, N. Y.
Two-story manufacturing building, 100 x 60 ft for O. Z. Electrical Mfg. Co., Brooklyn, N. Y. $150,000. Client, M. W. Frudakis, Architect, Brooklyn, N. Y.

Alteration of 100 x 100 ft garage for O. Z. Electrical Mfg. Co., Brooklyn, N. Y. $60,000. Client, M. W. Frudakis, Architect, Brooklyn, N. Y.

One-story industrial building, 150 x 60 ft, Brooklyn, N. Y. $50,000. Client, M. W. Frudakis, Architect, Brooklyn, N. Y.

St. Thomas The Apostle Chapel, West Hempstead, L. I. $200,000. Client, Joseph Mathieu, Architect, Brooklyn.

Alteration and remodeling of Public School 157, New York City. $1,200,000. Client, Salvati & Son, Architect, Brooklyn, N. Y.

Jaros, Baum and Bolles, New York City.
Design of air-conditioning system and mechanical engineering consultants for the House of Seagram, the world's first bronze skyscraper. System to control the first twenty floors from basement and 21st through 38th floor from roof.

Slocum & Fuller, New York City.
Brooklyn Navy Yard, advanced planning. $800,000. Client, U. S. Navy.

U. S. Mission to United Nations Building. $2,200,000. Client, Kahn & Jacobs.

Stevens Institute, laboratory building. $2,000,000. Client, John J. McNamara.

Sheraton Motel, Binghamton, N. Y. $2,100,000. Client, Samuel Glaser.

NORTH CAROLINA

T. C. Cooke, Durham, N. C.
Three dormitories, University of North Carolina. $2,000,000. Client, George W. Carr, Architect.

Ward building renovations, State Hospital, Butner, N. C. $1,000,000. Client, H. R. Weeks, Inc., Architect.

Relighting Coswell Building, Raleigh, N. C. $50,000. Client, State of N. C.

Elementary school, Durham, N. C. $400,000. Client, George F. Hackney & Charles F. Knott, Architects.

Dormitory addition, University of North Carolina. $350,000. Client, H. R. Weeks, Inc., Architect.

NORTH DAKOTA

Flahart & Colgan, Rapid City, S. D.
Rural telephone lines, 600 mi, N. D. $400,000. Client, Souris River Telephone Mutual Aid Corp., Velva, N. D.

OHIO

Wayne A. Becker, Cincinnati, Ohio.
Swimming pool project. 32 x 65 x 82½ ft. Fan shaped main pool, 140,000 gal.; 20 x 25 ft wading pool, 3700 gal; pressure sand filter plant and circulating system; play area, flood lighting, pool equipment, fencing, etc. $75,000. Client, Model City Development Co., Cameron Park Subdivision, Cincinnati, Ohio.

Swimming pool project. 60 x 150 x 42 x 35 ft. "T"-shaped main pool, 333,000 gal; 30 x 40 ft wading pool, 9000 gal; pressure sand filter plant and circulating system; play area, flood lighting, pool equipment, fencing, etc. Arrangement for future indoor pool to be operated from same filter plant. $150,000. Client, Jewish Community Center, Cincinnati, Ohio.

Willard F. Schade & Assoc., Cleveland.
Sewage treatment plant (0.7 mgd), and main trunk sewer. Solon, Ohio. $450,000. Client, Sanitary Eng. Dept., Cuyahoga County, Cleveland, Ohio.

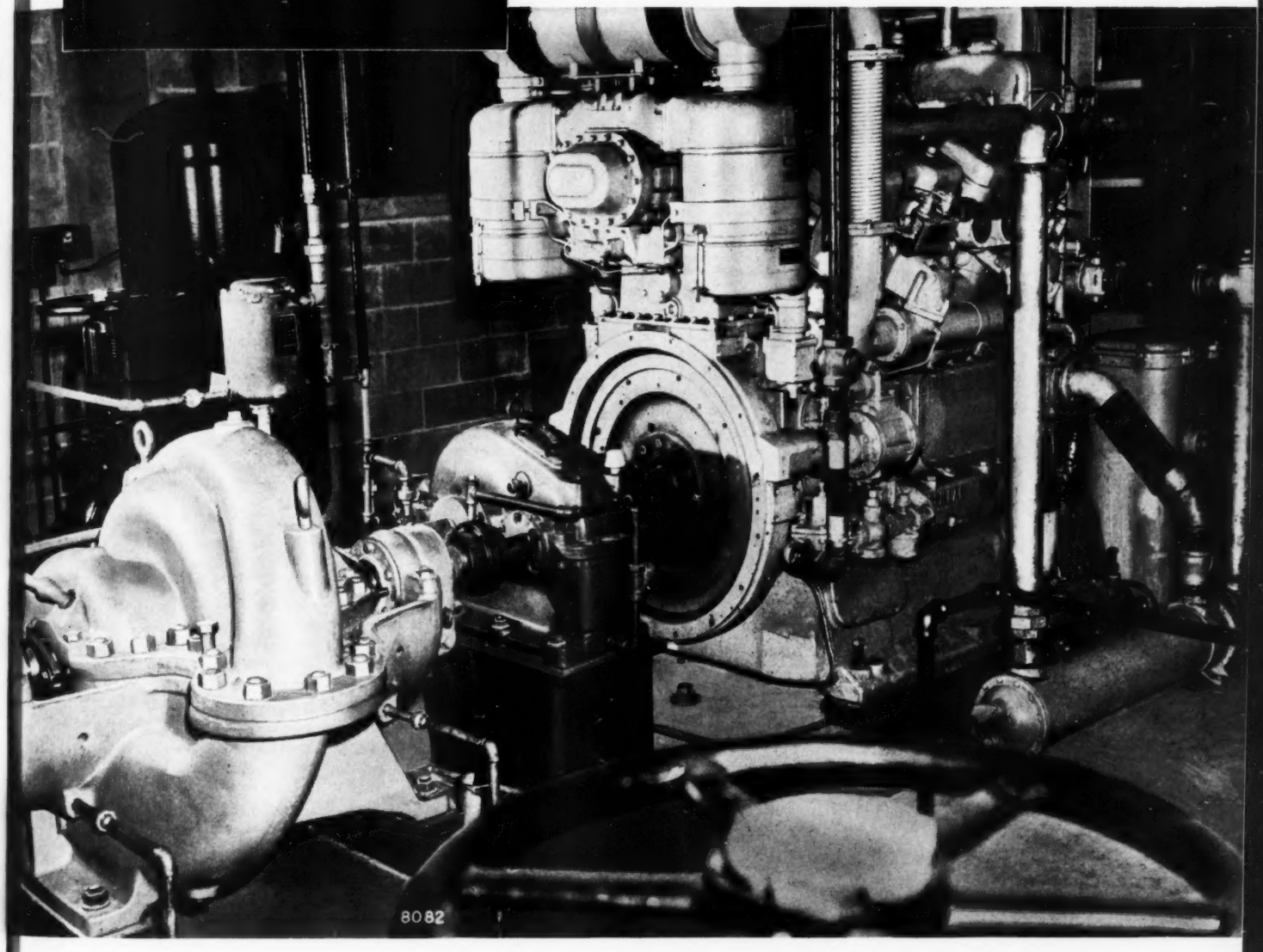
Alden E. Stilson and Assoc., Columbus.
Sewage treatment plant. Client, Steubenville, Ohio.

Hargett-Yanda & Barber, Cleveland.
Lakeland Freeway extension in Euclid from Cleveland line to East county line. $10,000,000 (construction) $5,000,000 (est.) (right-of-way). Client, City of Euclid, Ohio.

Willard F. Schade & Assoc., Cleveland, Ohio.
Sewage and industrial waste collection and disposal, involving General Motors

DE LAVAL
TWO-STAGE CENTRIFUGAL PUMPS

boost pressure at peak loads in Port Washington, New York



This De Laval two-stage horizontal split-case pump is one of a pair used to boost pressure during peak hours in the Port Washington, New York water works. Taking water from a large underground storage tank, these De Laval units maintain pressure throughout the system. The dependable centrifugal pumps are powered by Caterpillar diesels with speed increasers; they deliver 1500 gpm at 400 feet tdh with 15 feet lift requiring 185 bhp.

De Laval 2IS-2KS pumps are designed with • back-to-back impellers for balanced hydraulic thrust • easily replaceable threaded impeller wearing rings • long-life labyrinth case rings • ring-oiled ball bearings—plus ten other important design features. They are available in sizes from 2 inch to 8 inch discharge, for capacities to 3000 gpm and heads to 750 feet. *Write for Bulletin 1501 giving complete data.*

Consulting Engineer
Angus D. Henderson
Westbury, L. I., N. Y.

Contractor
D. Fortunato, Inc.
Floral Park, L. I., N. Y.

DE LAVAL *Centrifugal Pumps*

DE LAVAL STEAM TURBINE COMPANY

894 Nottingham Way, Trenton 2, New Jersey

Plant and area development in Lordstown Township and adjacent area. $1,000,000 (est.). Client, Board of County Commissioners, Trumbull County, Warren, Ohio.

Emmet J. McDonald, Akron, Ohio.
Munroe Falls, Ohio (Pinehurst suburb). 16,300 ft of sanitary sewer ($125,000) and 9700 ft of water main ($85,000). Subdivision includes about 200 homes, paved streets, and sidewalks. Client, Horning Land Co.

"Lake Renee Estates," located in Stow and Hudson Townships about 10 mi northeast of Akron, Ohio. 300 homes to be built, plus sanitary sewers, water lines, water plant, disposal plant, storm sewers, paved streets, and sidewalks. $3,500,000 (est.). Client, Mauro Construction Co.

William C. Kammerer and Associates, Cleveland, Ohio.
Kent State University, Kent, Ohio. New boiler in existing boiler plant. Boiler and stoker previously purchased. Bids now being taken on power piping, plumbing, and building alterations. $185,000. Client, Dept. of Public Works, Columbus, Ohio.

OREGON

Stevens & Thompson, Portland, Ore.
Water filtration plant for South Fork Water Board, 10 mgd capacity. Clackamas River as source. $1,350,000. Client, Cities of Oregon City and West Linn.

Cornell, Howland, Hayes & Merryfield, Corvallis, Ore.
Design of ammunition facilities for Umatilla Ordnance, Umatilla, Ore. $1,850,000. Client, Corps of Engineers.

Structural design of two buildings for the production of zirconium. Albany, Ore. $350,000. Client, Wah Chang Corp., New York, N. Y.

PENNSYLVANIA

Albert E. Peters Associates, Scranton.
Dual primary electric service and distribution, Allentown State Hospital, Pa. $550,000. Client, Commonwealth of Pennsylvania.

New boiler plant, Petersburg Silk Mill, Scranton, Pa. $100,000. Client, S. J. Aronsohn, Inc.

Harris, Henry & Potter, Inc., Doylestown, Pa.
700-home housing development, Hartsville, Pa. $11,900,000. Client, Walsh & Grant.

Maintenance and repair projects, Naval Air Station, Willow Grove, Pa. $161,400. Client, U. S. Navy.

George H. Kocyan & Son, Forty Fort, Pa.
Study of design methods and improvement of process (preliminary). $15,000. Client, Richmond Bakery.

Electronic application and quality control of stocking and knitting machine. $25,000. Client, Bearing Product Co.
U. S. Signal Corps electronic gear. $80,000.

The Ballinger Co., Philadelphia, Pa.
Three-floor home office building. Client, Philadelphia-United Life Insurance Co.

H. G. Metzger, Jr. & Associates, Huntingdon Valley, Pa.
Alterations and additions to spray paint shop facilities. $35,000. Client, Orianna Wagon Works, Inc., Philadelphia, Pa.

Peter F. Loftus Corp., Pittsburgh, Pa.
New 15,000 lb per hr steam generating unit with associated auxiliary equipment. $75,000. Client, Sewickley Valley Hospital, Sewickley, Pa.

TEXAS

Catalytic Construction Co., Philadelphia, Pa.
Engineering, procurement, and construction of Houdrifomer unit, Texas City, Texas. $2,000,000. Client, Texas City Refining, Inc.

Smith & Tao, St. Louis, Mo.
Addition to Federal Dial Building, Dallas, Texas. $300,000. Southwestern Bell Telephone Co.

The Stapp Engineering Corp., Denver.
Installation of gas compressor with buildings, piping, pressure vessels, and natural gasoline recovery. $550,000. Client, The Texas Co.

E. M. Freeman and Associates, Shreveport, La.
Two underpasses in connection with Common St. extension, Shreveport. $350,000. Client, Texas and Pacific Railway Co., Dallas, Texas.

UTAH

Templeton and Linke, Salt Lake City.
Construct sewage collection system. $270,000. Client, Riverdale City, Utah.

Construct water distribution system. $240,000. Client, Town of Clinton, Utah.

Construct sewerage system. $1,900,000. Client, Granger-Hunter Improvement Dist., Salt Lake County, Utah.

Construct sewer outfall mains and sewage treatment plant. $1,200,000. Client, Logan City, Utah.

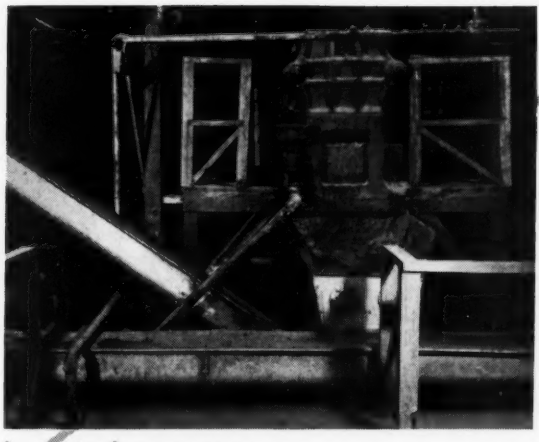
Construction of 33 mi of 12 and 54 in. sewer outfall mains and sewage treatment plant. $2,900,000. Client, North Davis County Sewer Dist., Clearfield.

Construction of 2 deep wells, 4 steel water tanks, 24 mi of water distribution mains 4 to 12 in. $1,265,000. Client, Salt Lake County Water Conservancy Dist., Salt Lake City, Utah.

VIRGINIA

Ballinger-Meserole Co., Philadelphia, Pa.
Design of new warehouse of 150,000 sq ft with air conditioned offices and shipping docks. Client, Richmond Food Stores, Inc., Va.

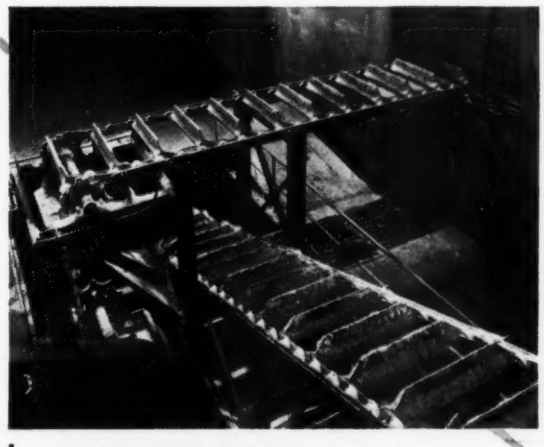
by conveyor belts



by spiral conveyors

If you move materials

by bucket elevators



by scraper conveyors

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equipment incorporating the know-how gained in three-quarters of a century of studying and solving material-handling problems. Today, in thousands of plants throughout the world, Jeffrey conveying equipment is depended upon to maintain high production schedules, lighten the burden of labor and reduce operating costs.

Write for Catalog 860 describing Jeffrey material-handling and processing equipment. For high quality parts matching those originally installed on your equipment, get in touch with a nearby Jeffrey distributor or The Jeffrey Manufacturing Company, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT
TRANSMISSION MACHINERY • CONTRACT MANUFACTURING

Johnson & Williams, Washington, D. C.
Storm drainage and street improvements, Falls Church, Va. $490,000. Client, City of Falls Church, Va.

Water system improvements and extensions, South River Sanitary District, Augusta County, Va. $485,000. Client, South River Sanitary District, Augusta County, Va.

Lockwood Greene, Boston, Mass.
Headquarters plant for Rectifier Dept. 1-story, 200,000 sq ft, including air-conditioned laboratories, and a 2-story 40,000 sq ft air-conditioned office, Lynchburg, Va. Client, General Electric Co., Schenectady, N. Y.

Nicolay Titlestad Corp., New York.
New sulfur furnace, waste heat boiler, converter, piping, etc. for incorporation into existing sulfuric acid plants at Norfolk, Va. $100,000. Client, Smith-Douglass Co., Inc.

WASHINGTON

Carey and Kramer, Seattle, Wash.
Design and inspection of new water and sewerage system for Mercer Island, Wash. $3,400,000. Client, Mercer Island Water & Sewer Districts.

Advance planning for new dry dock at Puget Sound Naval Shipyard, Bremerton, Wash. Joint venture with **Moran, Proctor, Mueser and Rutledge,** New York. $38,000,000. Client, U. S. Navy.

Design, consultation, and inspection of new sewerage system, 2 mi of cast iron pipe, 9 sewage lift stations in Puget Sound Naval Shipyard, Bremerton, Wash. $700,000. Client, U. S. Navy.

H. A. Sewell & J. A. Sewell, Newport and Spokane, Wash.
Sullivan Creek Power Project. Acquisition of present plant from Inland Portland Cement Co. — 30,000 acre ft storage to produce 3000 kw of power for downstream plants. $1,000,000. Client, Public Utility District No. 1, Pend Oreille County, Wash.

WYOMING

Associated Engineers, Inc., Billings, Mont.
55-mi 69-kv transmission line near Powdered River, Wyo., including two substations. $600,000. Client, Hot Springs Elec. Coop., Thermopolis, Wyo.

Norman H. Todd, Denver, Colo.
Fox Theater remodeling. Rock Springs, Wyo. $100,000. Client, Fox Intermountain Theaters.

FOREIGN

E. J. Kelly & Associates, Inc., Los Angeles, Calif.
Pineapple juice concentrator and essence recovery. Design and furnish complete equipment including 500-kw diesel generating plant. $350,000. Client, Philippine Packing Corp. (Div. of California Packing Corp.), Bugo, Philippine Islands.

Holmes & Narver, Inc., Los Angeles.
Engineering studies and preliminary plans for complete sewerage system for the community of Kailua, Oahu. Client, City and County of Honolulu.

D. B. Steinman, New York City
Design and supervision of construction of a suspension bridge to span the Tigris River at Baghdad. $5,000,000. Client, Government of Iraq.

Gibbs & Hill Inc., New York City
Design of Shen Ao power plant, Taiwan, Formosa, 75,000 kw. Client, Taiwan Power Co.

The Fluor Corporation of Canada, Ltd.
Engineer and construct offsite facilities in conjunction with new reformer and crude units. $4,000,000. Client, British American Oil Co., Ontario.

Engineer and construct detergent alkylate plant at Sarnia, Ontario, Canada. $3,800,000. Client, Imperial Oil Ltd.

Sasnett Engineering, Inc., New York.
300-room resort hotel. San Juan, Puerto Rico. Air conditioning, plumbing, and electrical. $4,500,000. Client, Intercontinental Hotels, Inc.

Renovation of British Colonial Hotel, Nassau, Bahamas, B.W.I. $1,500,000. Client, British Colonial Hotel Ltd.

Kaiser Engineers, Oakland, Calif.
Design, construct, and equip expansion of present manufacturing facilities. $130 million. Client, Tata Iron & Steel Co., Jamshedpur, India.

Rader and Associates, Miami, Fla.
Plan and design complete water system for Cartagena, Colombia and six nearby towns. $10 million. Client, Empreses Publicas.

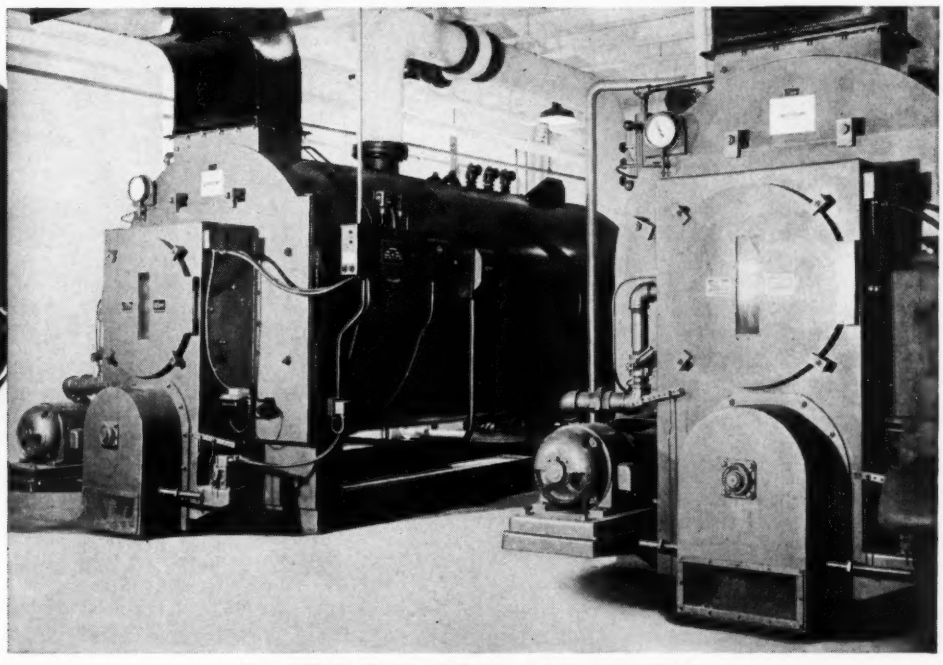
Brown, Blauvelt and Leonard, New York City.
Assist development of 300 ton/month titanium dioxide plant. Client, Nisso Steel Mfg. Co., Tokyo, Japan.

Ebasco International Corp., New York City.
Design engineering and purchasing for two Mexican power stations: One for Cia. Electrica Mexicana, S. A. at Puebla, and one for Cia. Hidroelectrica Guanajuatense, S. A. at Celaya. Client, above companies, which are subsidiaries of American and Foreign Power Co.

PLEASE REMEMBER

To send us information on your New Projects for listing in this column — name or type of project; whether you did the mechanical, electrical, structural, or other types of engineering; location; total estimated cost; and name of the client.

"No engineer likes a gamble. That's why I want the UNFAILING DEPENDABILITY of Packaged Boilers"



Two 175-HP Gas-Fired Continental Automatic Boilers, installed at Tri-County Joint School District, Canton, Pa.

"As an engineer, I can't afford to take a chance. So when we design a modern heating plant, I make certain we get dependability. In fact, that's why I insist on Packaged Boilers.

"Heating, power and process requirements are always of vital importance. That's why two Packaged Boilers, each designed to carry 75% of the maximum demand, may very well be a better buy than one built-up firebox type of boiler. Sure, that's conservative designing. But it pays off in winter-long reliability, no matter what the weather.

"Later, if new buildings are added or there's some other need for increased steam production, it's easy and economical to install another Packaged Boiler. So we not only get dependability, but flexibility, too. That kind of a package makes everybody happy."

Six Reasons Why it Pays to Buy a CONTINENTAL Automatic Boiler

* Guaranteed 80% efficiency . . . Fire-tested before shipment . . . Range, 20 to 500 hp.
* Simple, practical two-pass design, for uniform flow of combustion gases through all return tubes.
* Maximum radiant heat transfer achieved by "Spinning Gas" technique for thorough mixing of air and atomized fuel.
* High-CO_2 and low-temperature stack gases — proof of high combustion efficiency.
* Free, rapid water circulation improves heat transfer, keeps heating surfaces clean.
* Easy access to furnace and all return tubes. Refractory baffles and brickwork are not required.

For details on the Continental Automatic Boiler, send for Bulletin BE-3

BOILER ENGINEERING & SUPPLY COMPANY, INC.

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A HALF CENTURY OF BOILER MANUFACTURING EXPERIENCE

The Continental AUTOMATIC BOILER

Books

For

Consulting Engineers

POWER SYSTEM STABILITY, Volume III (Chapters XII-XV), SYNCHRONOUS MACHINES, by Edward Wilson Kimbark; John Wiley & Sons, Inc., 322 pp.; $10.00.

Reviewed by Harold G. Behm
Principal Electrical Engineer
Battelle Memorial Institute

Synchronous Machines is the third volume of a well-written, concise, practical coverage of stability problems associated with generation and transmission of electric power. In this volume, the author goes deeper into the calculation of stability than in Volume I, by covering in more detail the properties of synchronous machines.

The author indicates that Volume I, covering the elements of the stability problem, is a prerequisite to Volume III. However, those interested primarily in synchronous machines will find the first three chapters of this volume an excellent practical review of the characteristics of synchronous machines and their excitation systems.

A brief review of the fundamental concepts of inductances and flux linkage is included at the beginning of the first chapter. A good concept of the various synchronous machine reactances and time constants is presented, as well as discussion of the physical parts of the machine (field iron structure, field winding, amortisseur winding, etc.) which affect the values of these constants. Typical ranges of the value of these constants are included for solid rotor turbo alternators, water-wheel generators, synchronous condensers, and general-purpose synchronous motors. The method of obtaining values of these constants from graphical analysis of a generator short-circuit oscillogram is shown. The author develops the mathematical theory of the synchronous machine, and applies it to problems of transient and steady-state stability calculation with statements regarding magnitude of errors resulting from simplifying assumptions made. Methods of representing circuits on an a-c calculating board are mentioned briefly.

A chapter is devoted to the excitation systems for synchronous machines. Descriptions of the various methods in use are illustrated by showing the operation of actual commercial excitation systems including several methods of automatic voltage regulation. The exciter response and the relation to the stability problem are developed.

Chapter XIV describes the types of damper or amortisseur windings and shows their effect on the machine constants and upon stability. The author indicates that in only a few cases is the damper winding designed with regard to its effect upon stability. Even though the design is governed by other factors, the damper winding does exert an effect on stability which must be considered.

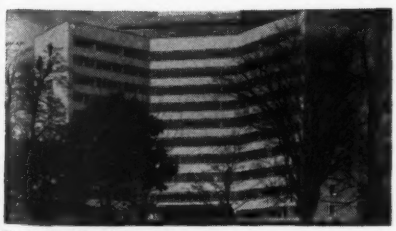
The final chapter discusses the steady-state stability limit. The author points out that steady-state stability limit becomes the upper limit of the transient stability as this limit is raised by improvements in protective relays and circuit-interrupting devices. He further presents the development of equations and graphical methods of determining the steady-state stability limit for a number of conditions. An extensive list of references and a number of typical problems are included for each chapter. The book is a very readable volume, with adequate illustrative examples to give the reader a better understanding of and feel for the problem.

ALSO AVAILABLE

PATENT NOTES FOR ENGINEERS, 7th Ed., by C. D. Tuska; McGraw-Hill Book Company, Inc.; 192 pp.; $4.00.

Originally prepared for the use of RCA engineers only, this book gives a clear idea of what patentable inventions are and how to protect them. Engineers will find chapters

Specify RECO



Rhode Island Hospital, Providence, R. I.
Shepley, Bulfinch, Richardson & Abbott—Architects & Engineers
Merrill Associates—Heating, Ventilating and Air Conditioning Engineers
Elhatton Plumbing & Heating Co.—Plumbing Contractor
W. B. Parsons Co.—RECO Representative, Needham, Mass.

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RHODE ISLAND HOSPITAL's new 452 bed Main Building relies on RECO Hot Water Storage Heaters for plenty of hospital-pure hot water. Made of tough, rust-proof copper silicon, these RECO storage heaters were ASME built and tested to *deliver over 10,000 gallons of 180° hot water* per hour, every hour. And RECO guarantees this performance.

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RICHMOND ENGINEERING CO., INC.

on record keeping, and record application in patent interference, particularly valuable.

Statutory invention, its nature and practical aspects, is covered thoroughly to give the reader a view of the subject through the eyes of the courts.

•

STREAMLINED SPECIFICATION STANDARDS, Vol. II, MECHANICAL AND ELECTRICAL, by Louis Axelbank and Ben John Small; Reinhold Publishing Corp.; 512 pp.; $10.00.

This is a guide to organized specification writing for mechanical and electrical services in buildings. Standardized and well-defined abbreviations are used to provide the specification writer with a short cut method for the composition of good specifications.

•

APPRAISAL AND VALUATION MANUAL, edited by Paul B. Coffman; American Society of Appraisers; 500 pp.; $15.00.

A source book of the latest information on the solution to appraisal and valuation problems encountered in business and government, this is a revised version of the 1956 manual. Among the new additions are such studies as: "Appraising — A Constant Challenge," by Olin Price; "Depreciation — Public Utility Properties," by Horace B. Perry; "What's Happening to Construction Costs," by Myron L. Matthews; "The G. I. Appraisal Process," by Harry W. Ninde; and "Appraising Industrial Property for Ad Valoram Tax," written by A. R. Von Lehe.

•

"Guides for Community Planning," an annotated planning bibliography prepared by the American Society of Planning Officials, contains more than 475 entries on planning subjects, including such topics as air pollution, business and shopping centers, economic base, industry, parking, traffic, transit, urban renewal, and zoning. Copies of this 52-page book are available from the Society at 1313 E. 60th St., Chicago 37, Ill. Price is $2.50 ($1.50 to ASPO members).

•

CONTRACTS, SPECIFICATIONS, AND ENGINEERING RELATIONS, 3rd Ed., by Daniel W. Mead (Rewritten by the staff of Mead and Hunt, Inc., Consulting Engineers); McGraw-Hill Book Company, Inc.; 427 pp.; $7.00.

This edition has the same purpose as the first two—to set forth the important relations with which the engineer and architect should become familiar when starting their professional career. The basic discussion of ethics closely follows the treatment by Daniel W. Mead, the original author.

Special attention is given to the writing of reports and business letters. The specifications section is based on material currently used by consulting engineers and architects, with a complete set of specifications included as an appendix.

•

PLANT LOCATION, by Leonard C. Yaseen; American Research Council; Inc.; $10.00.

Written by the senior partner of Fantus Factory Locating Service, this book is a complete working manual of factors entering into choice of a satisfactory site, including raw material sources, labor supply and rates, markets, utilities, taxes, climate, and safety.

•

The following material is available from the Office of Technical Services, U. S. Dept. of Commerce, Washington 25, D. C.

"Hydrogen Embrittlement and Static Fatigue in High Strength Steel," by R. D. Johnson, et. al., Case University of Technology for Wright Air Development Center; 41 pp.; $1.25. Order No. PB 121064.

"Onset of Fast Crack Propagation in High Strength Steel and Aluminum Alloys," by G. R. Irwin, Naval Research Laboratory; 16 pp.; $.50. Order No. PB 121224.

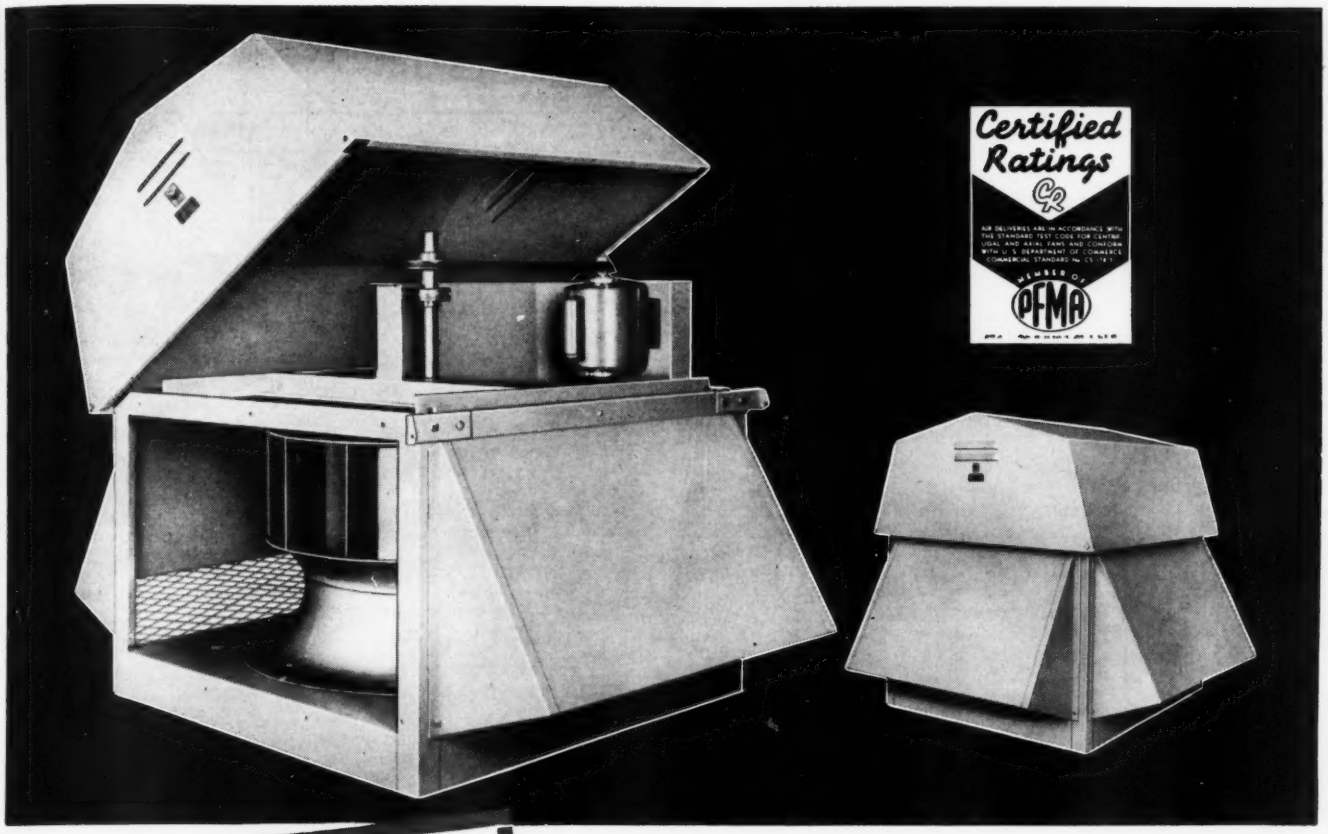
"A Review of the Air Force Materials Research and Development Program," by Mary M. Sokas, Wright Air Development Center, U. S. Air Force; 137 pp.; $3.50. Order No. PB 111648S. (Covers Air Force research from July 1, 1954 to June 30, 1955.)

"First Joint Military, Industry Packaging and Materials Handling Symposium," U. S. Navy, 695 pp.; $6.00. Order No. PB 121350.

"Bibliography of the Material Damping Field," by L. J. Demer, University of Minnesota, for Wright Air Development Center; 105 pp.; $2.75. Order No. PB 121437.

TO ORDER BOOKS

As a readers' service, CONSULTING ENGINEER will order reviewed books or any other technical volumes. In ordering books, give title, author, and publisher and enclose check. Address is 227 Wayne St., St. Joseph, Michigan.



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NEW Peerless-Electric®

Centrifugal Roof Ventilator...

DEVELOPED AND MANUFACTURED WITH APPLIED CENTRIFUGAL BLOWER PRINCIPLES

QUIET! . . . Matching wheel cone accurately fits venturi inlet to create quieter, smoother air movement. Excellent for churches, auditoriums, hospitals, and schools.

ADAPTABILITY! . . . Fits standard curb sizes. Lower horsepower ratings for quieter operation. Higher horsepower for commercial and industrial applications.

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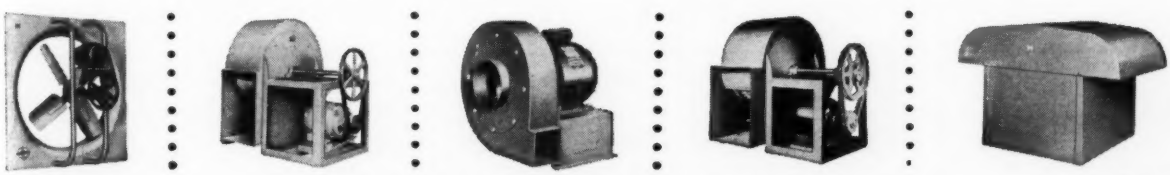

Charter Member of the Air Moving and Conditioning Association, Inc.

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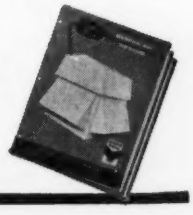

consulting engineers' calendar

Date	Sponsor	Event	Location
Jan. 17-18	International Management Association	Conference—"Case Studies in Foreign Operations"	Hotel Roosevelt New York, N. Y.
Jan. 21-22	Association for Applied Solar Energy	Symposium on Solar Furnace Design	Hotel Westward Ho Phoenix, Ariz.
Jan. 21-25	American Institute of Electrical Engineers	Winter General Meeting	Hotel Statler New York, N. Y.
Jan. 23-24	University of Wisconsin	Industrial Lighting Institute	Campus Madison, Wis.
Jan. 28-Feb. 2	American Road Builders' Association	1957 Road Show and Convention	International Amphitheater Chicago, Ill.
Jan. 30-31	Armour Research Foundation and Chicago Chapter of American Welding Society	3rd Annual Midwest Welding Conference	Illinois Institute of Technology Chicago, Ill.
Feb. 5-7	Society of the Plastics Industry, Inc., Reinforced Plastics Division	12th Annual Technical and Management Conference	Edgewater Beach Hotel Chicago, Ill.
Feb. 15-16	National Society of Professional Engineers	Spring Meeting	Hotel Francis Marion Charleston, S. C.
Feb. 18-22	American Society of Civil Engineers	Convention	Jackson, Miss.
Feb. 25-28	American Concrete Institute	53rd Annual Convention	Statler-Hilton Hotel Dallas, Texas
Feb. 25-Mar. 1	American Society of Heating and Air-Conditioning Engineers	Annual Meeting and Heating and Air-Conditioning Exposition	International Amphitheater and Conrad Hilton Chicago, Ill.
March 3-6	American Institute of Chemical Engineers	Meeting	Greenbrier Hotel White Sulphur Springs, Va.
March 7	American Institute of Consulting Engineers	Monthly Luncheon Meeting	Engineers' Club New York, N. Y.
March 11-15	National Association of Corrosion Engineers	Annual Conference and Exhibition	Kiel Auditorium St. Louis, Mo.
March 15-17	Society of Women Engineers	6th Annual National Convention	Shamrock-Hilton Hotel Houston, Texas
March 18-21	Society of Plastics Industry, Inc.	Plastics Exposition and Annual National Conference	Shrine Exposition Hall Los Angeles, Calif.
March 21	Connecticut Society of Civil Engineers	Annual Meeting	Waverly Inn Cheshire, Conn.
March 25-27	American Society of Tool Engineers	Technical Meeting and Convention	Shamrock-Hilton Hotel Houston, Texas
March 27-29	Illinois Institute of Technology	19th Annual American Power Conference	Hotel Sherman Chicago, Ill.
March 27-29	Office of Naval Research and the Martin Company	Educational Colloquim—"Radiation Effects on Materials"	Johns Hopkins Univ. Baltimore, Md.
April 14-17	United States World Trade Fair	Exposition	New York Coliseum New York, N. Y.

SPECIAL AND PROFESSIONAL SERVICES